2019

Mining the Evidence: Public Comments, Evidence-Based Policymaking, and a Controversial Mine

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MINING THE EVIDENCE:

PUBLIC COMMENTS, EVIDENCE-BASED POLICYMAKING, AND A CONTROVERSIAL MINE

By

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A THESIS

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

In Environmental and Energy Policy

MICHIGAN TECHNOLOGICAL UNIVERSITY

2019

This thesis has been approved in partial fulfillment of the requirements for the Degree of MASTER OF SCIENCE in Environmental and Energy Policy.

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Acknowledgments

So many people have helped me academically, mentally, and emotionally succeed while researching for and writing this thesis. Thank you to my advisor, Nancy Langston, for all your input and wisdom that has helped me succeed in graduate school. Thank you to Adam Wellstead for igniting my interest in public policy and continually asking me "where's the policy?" while writing my thesis. Thank you to Carol MacLennan for your positive support and feedback, which helped my research ideas grow into this final product. I owe thanks to the entire Department of Social Sciences, especially Angie Carter and Val Gagnon for their guidance. I would like to also thank the Department of Social Sciences and the Great Lakes Research Center for providing funding to complete my research. Finally, I would like to thank my friends from Michigan Tech and abroad and my family for challenging and supporting me throughout this entire process. Without all of you, I may not be where I am today.

List of abbreviations

ACOE: Army Corps of Engineers

APA: Administrative Procedure Act

DNR: Department of Natural Resources

EBPM: Evidence-Based Policymaking

EPA: Environmental Protection Agency

EQB: Environmental Quality Board

MEPA: Minnesota Environmental Policy Act

MPCA: Minnesota Pollution Control Agency

NEPA: National Environmental Policy Act

ROD: Record of Decision

USFS: United States Forest Service

Abstract

In policymaking, evidence-based policymaking is an essential method for influencing policies and decisions by telling decision-makers "what works" (Head, 2008). Western sciences typically make up most of the evidence decision-makers use, but because people are boundedly rational in understanding and incorporating it—politics, values, and beliefs impact thought processes— scholars and policymakers also include other types of knowledge to make decisions. One way for decision-makers to incorporate other types of knowledge into policies is through public comments. Although public comments may provide different types of knowledge to improve policy decisions, decision-makers face challenges with valuing different types of knowledge as evidence. This study asks: how do decision-making agencies analyze and value knowledge from public comments? Examining the Final Environmental Impact Statement (FEIS) of the proposed PolyMet mine in Minnesota, I look at how the Minnesota Department of Natural Resources valued different types of knowledge from public comments. Using a qualitative coding and analysis methods, I analyze the public comments of the FEIS, using the theories from evidence-based policymaking to examine potential bias, legal interpretations, and the value of knowledge from the DNR. I argue that the DNR, following state legal requirements, tended to value expert knowledge as more important in their decision-making process. By broadening their scope of knowledge use, the DNR may increase transparency, reduce bias, and increase public acceptance of their decisions.

1 Introduction

Evidence-based policy research examines the use of evidence to influence and make policies (Head, 2008). Scholarship on the evidence-based policy research (EBP) began in the 1960s, and in the 1990s, EBP scholars began examining the ways different actors influenced policies and decisions by using evidence to tell decision-makers "what works" (Head, 2008; Sanderson, 2000). EBP scholars, public managers, and policymakers have primarily considered Western scientific knowledge—such as physical, ecological, and biological sciences—as the primary form of evidence to help inform decisions because they see it as rational and apolitical (Head, 2010a). However, focusing solely on Western scientific knowledge (from here on out called "scientific knowledge") as evidence in policy decision making has limits. Other types of important knowledge types exist that decision-makers can and should use—but often do not—to make and influence decisions.

One way that decision-makers can use evidence-based policymaking and different forms of knowledge to make decisions is through the collection and use of public comments. Public comments provide decision-makers with an array of different types of knowledge from scientific researchers, tribal governments and organizations, citizens, NGOs, and other groups. Because of the opportunity for many different groups of people to provide comments as evidence during a commenting process, public comments can be an invaluable resource of evidence-based policymaking.

However, while public comments provide an opportunity for decision-makers to broaden evidence, there are challenges with these types of evidence that involve non-

expert knowledge—that may make them less valuable or more difficult to use by decision-makers (Epstein, Farina, & Heidt, 2014). One example is how decision-makers value certain types of knowledge—say, scientific expertise—over others (Head, 2008). Additionally, when focusing on scientific expertise, researchers and decision-makers face the challenges of bounded rationality where values, beliefs, emotions, and political agendas influence data presentation from researchers and interpretation by decision-makers (Botterill & Hindmoor, 2012). Additional challenges exist, such as policy analytical capacity and issue controversy that may limit the ability of decision-makers to use evidence-based policymaking effectively.

Given some of these challenges and flaws of evidence-based policymaking, this thesis uses an EBP approach to ask: how do decision-making agencies interpreting laws and regulations to analyze public comments? Do decision-makers, when reviewing these comments, value and use different types of knowledge differently? For example, are public comments by scientific experts valued differently than citizen comments about how a project will affect their community?

The proposed PolyMet copper and nickel mine in northeastern Minnesota serves as a case study to examine how decision-makers use public comments as evidence in decision-making processes. The proposed PolyMet mine is an excellent case study because of its lengthy fifteen-year process that has led to nearly 100,000 public comment submissions throughout five decision-making phases: the scoping, draft environmental impact statement, supplemental draft environmental impact statement, final environmental impact statement, and permitting phases (figure 3.1). While decision-makers of this project have promoted the collection of public comments as evidence to

make decisions, it is unclear whether these types of knowledge influence changes in policy outcomes. This thesis explores this type of evidence and its effect on these outcomes by focusing on the final environmental impact statement (FEIS) phase. Because of the different legal requirements and the number of total public comment submissions, the other four phases of the PolyMet project are beyond the scope of this study.

From the PolyMet case study of the FEIS public comments, my primary goal is to look at how the DNR valued different types of knowledge as evidence through how they coded public comments as substantive. Here, a substantive comment may change the content of the document or warrant a response from the agency. By using qualitative coding and content analysis, this thesis adds to the empirical study of evidence-based policymaking and use of various knowledge types. The results also provide an in-depth analysis of public comments in Minnesota that may help citizens and others submit comments and for public administrators to review such information.

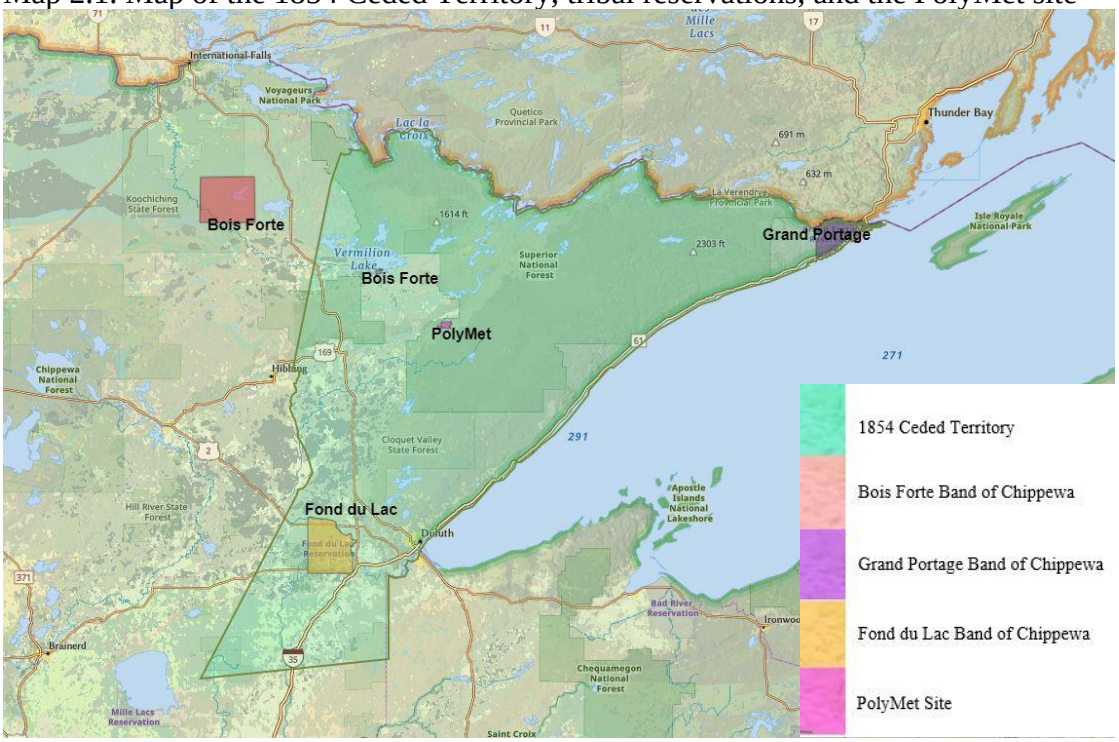
1.1 Outline of Thesis

This thesis contains seven chapters. Chapter One is the introduction. Chapter Two provides a detailed background on the proposed PolyMet mine in northeastern Minnesota, the five phases of public commenting on the mine, and the key federal and state public participation policies. Chapter Three is a literature review on evidence-based policymaking, focused on the different types of knowledge that decision-makers can use as evidence as well as some flaws of evidence-based policymaking. Chapter Four lays out research methods and data to answer the questions of how decision-makers use public comments as evidence and how they treat different types of knowledge for the proposed PolyMet mine. Chapters five and six provide the results and discussion of these public

comment analyses. Finally, chapter seven includes the limitations of this project, the opportunities for future research, and conclusions about how decision-making agencies use evidence-based policymaking through public comments.

2 Background on the PolyMet Proposal

Map 2.1. Map of the 1854 Ceded Territory, tribal reservations, and the PolyMet site



For nearly fifteen years, the PolyMet Mining Corporation has been working to build Minnesota's first-ever copper-nickel sulfide mine called the NorthMet Project located in northeastern Minnesota. The potential for sulfide mining has brought both economic opportunities and concerns over the potential health, environmental, economic, and cultural impacts that the mining of sulfide-bearing ores might bring. The opportunities and concerns have ignited discussions among numerous actors in how Minnesota should proceed with the proposed PolyMet mining project.

PolyMet's mining proposal began in the early 2000s when the company conducted a pre-feasibility study on the NorthMet ore deposit in northeastern Minnesota to examine the possibility for an open-pit mine to extract copper and nickel ("History of PolyMet in Northern MN: Heritage," n.d.). Following this study, PolyMet began an environmental

review process and released a feasibility study in 2006 (Dunbar, 2013). The following years of this feasibility study led to key decisions by federal and state agencies and growing participation and commentary by the public on the potential positive and negative impacts of the proposed mine.

For the time that PolyMet has been working on its mining proposal, there has been growing opposition and support for the project, leading to large numbers of citizens engaging with the decision-making process at every available opportunity. There are four broad topics that supporters and opponents of the PolyMet mine have discussed over nearly fifteen years: environmental risks, financial assurances, the economy, and jobs. First, for those who oppose the project, they worry about the enormous environmental risks a sulfide min could bring to the state (Kraker & Nelson, 2018). When sulfides are exposed to water and air, they create sulfuric acids, which permanently impact the state's water (Kraker & Nelson, 2018; Phadke, 2018). Other key environmental concerns include the loss of productive wetlands, impacts on wildlife from ecosystem degradation, air pollution, and legacy pollution (Kraker & Nelson, 2018; Phadke, 2018). The second concern of opponents of the PolyMet project is that the company does not have the money to fund this project or can provide financial assurances to prevent legacy pollution in the future (Kraker & Nelson, 2018).

Those who support the PolyMet project often note that this brand new state-of-the-art mine would set a precedent in Minnesota to bring more sulfide mines to the state that would boost its economy (Kraker & Nelson, 2018; Phadke, 2018). This mine would especially impact the economy of the Iron Range region (map 2.1), which has seen a loss of economy and jobs because of the decline of the steel industry (Kraker & Nelson,

2018). The PolyMet project offers 360 direct jobs over the mine's two decades, as well as potential indirect jobs (Kraker & Nelson, 2018). Interest in economic growth on the Iron Range means that support for the project spans the political spectrum. For instance, in addition to a majority of state and federal Republican representatives supporting the project, many Democrats, including Senator Amy Klobuchar support the project as well (Ferguson, 2019; Orenstein & Schneider, 2019).

Three tribal governments—the Fond du Lac, Bois Forte, and Grand Portage bands of Lake Superior Chippewa—retain rights to hunt, fish, and gather on the 1854 Ceded Territory as sovereign and equal governments (map 2.1) (Enger, 2016). Because the PolyMet Corporation's mine would be on the 1854 Ceded Territory, the tribal governments, as sovereign nations, have an equal voice on tribal well-being, including environmental, historical, and cultural impacts (Staff of Boise Forte, Fond du Lac, Grand Portage, GLIFWC, & 1854 Treaty Authority, 2013). This equal say in decisions establishes a government-to-government relationship with state and federal agencies, which President Bill Clinton established in 2000 under an executive order and which Minnesota Governor Mark Dayton codified in 2013 also using an executive order (Clinton, 2000; Dayton, 2013). Under these executive orders, the three tribal governments located on the 1854 Ceded Territory were consulted by the state and federal decision-making agencies at every stage of the decision-making process on the PolyMet mine (Clinton, 2000; Dayton, 2013) well before the public comment periods.

The debate over the PolyMet mine intensified when the Minnesota Department of Natural Resources (DNR) released the company's draft environmental impact statements (DEIS) for public review (Dunbar, 2013). The DEIS sparked concerns by environmental

groups, tribal governments, and concerned citizens over the potential negative impacts that the proposed mine might have on the environment, public health, cultural resources, and more. In 2010 the federal Environmental Protection Agency (EPA) deemed PolyMet's DEIS inadequate, citing concerns regarding the company's proposed efforts to mitigate environmental, health, and cultural impacts (Dunbar, 2013; Hemphill, 2010). Following three years of edits by PolyMet on their DEIS, the company released a supplemental draft environmental impact statement (SDEIS), which the EPA deemed as much improved and adequate (Phadke, 2018). Despite continued debates over potential negative impacts from the mine, the DNR accepted PolyMet"s final environmental impact statement (FEIS) in mid-2016 (Phadke, 2018).

As of 2019, the Minnesota Department of Natural Resources (DNR), Minnesota Pollution Control Agency (MPCA), and the federal Army Corps of Engineers (ACOE) granted key permits for the PolyMet (Karnowski, 2019; Kraker, 2018). However, shortly after the MPCA granted their permits, a retired EPA attorney filed a complaint to the EPA's inspector general, noting that the EPA region five in Chicago suppressed agency comments over concerns on the PolyMet water quality permit (Kraker, 2019a). Although the EPA prepared written comments, the agency never submitted those comments during the public commenting period, and the MPCA and the EPA agreed that they would discuss these concerns over the phone (Kraker, 2019a). Because the MPCA discussed these concerns over the phone, they are not part of the public record, and several environmental organizations have brought this case to the Minnesota Court of Appeals, (Kraker, 2019a, 2019b). As of July 2019, the Minnesota Court of Appeals ordered hearings on how the MPCA dealt with the EPA's comments on the water quality permit

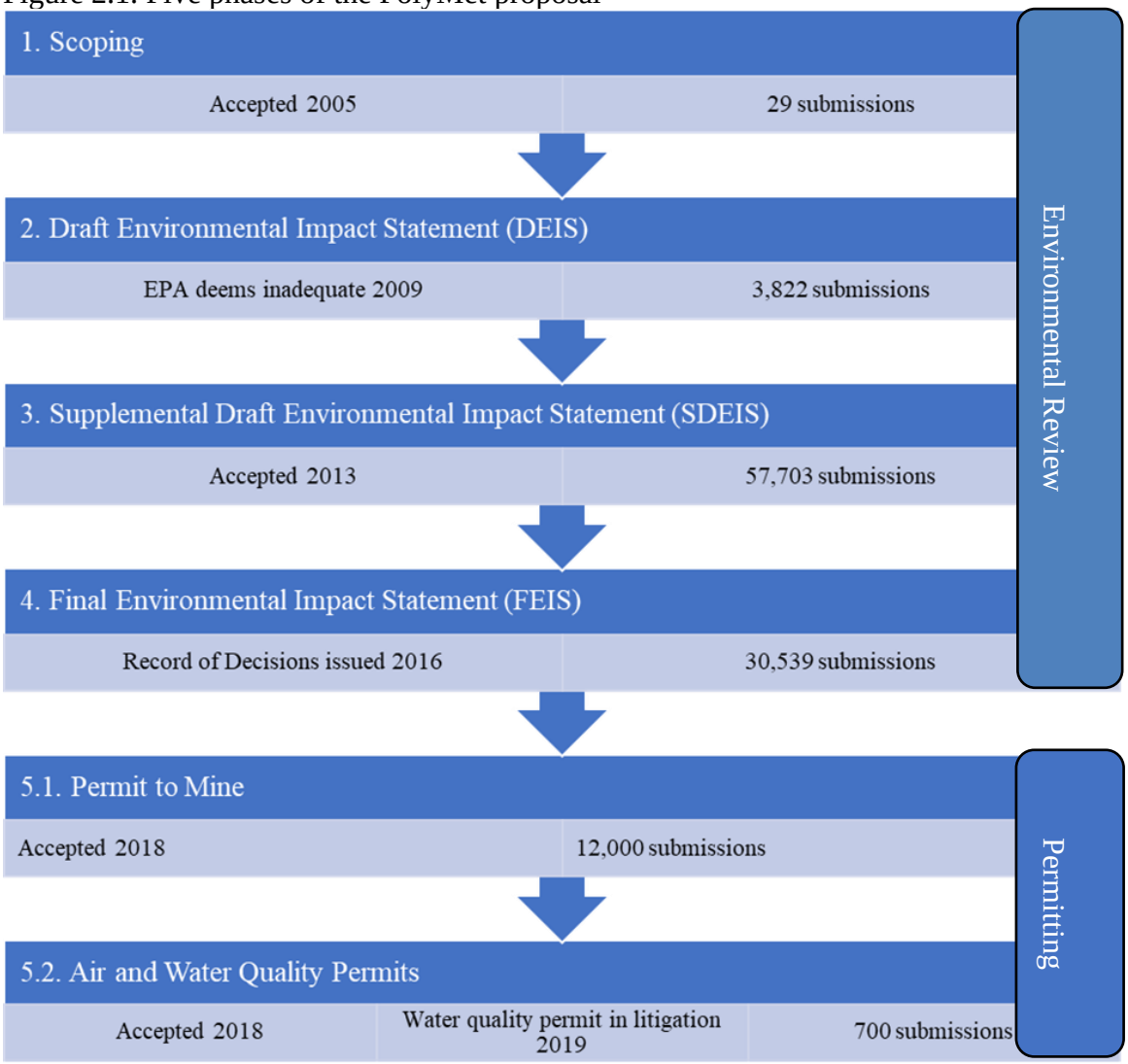
(Kraker, 2019b). As this current appeals process highlights, the public, including environmental organizations, have increasingly participated in and demonstrated the importance of the public in decision-making processes.

2.1 Public Participation in the PolyMet Project

Table 2.1 about here

Minnesota has detailed standards for citizen engagement in environmental decision-making processes, promoting public hearings and comment periods throughout the environmental impact statement and permitting processes (see Table 2.1). Under the National Environmental Policy Act (NEPA) and the Minnesota Environmental Policy Act (MEPA), federal and state agencies have detailed requirements for promoting and responding to public comments and hearing information and consider these data when making decisions (Bessette & Lintner, 2012). Citizens have tested these participatory standards with the PolyMet mine proposal—one of Minnesota's most participated in decision-making processes ever (Phadke, 2018). The decision-making agencies led by the Minnesota DNR as the Responsible Governing Unit who has jurisdiction on this project (see Minn. R. § 4410.0500), received close to 100,000 public comments on the project between the scoping, draft EIS, supplemental draft EIS, final EIS, and permitting processes. Figure 2.1 shows the process of the PolyMet proposal, the year the agencies made a final decision, and the number of public submissions the agencies received during comment periods.

Figure 2.1. Five phases of the PolyMet proposal



The first phase of the decision-making process that involved public comments was the scoping period. The purpose of the scoping process was to find all significant issues with a project and provided background information for the EIS and produced an environmental worksheet for the EIS. The DNR released this background information and environmental worksheet for public comment and held a public meeting to hear citizen feedback (DNR, 2016). During the public meeting and a thirty-day comment period, the DNR received twenty-nine comment submissions from the public (DNR,

2016). In collecting these comments, the DNR did not need to respond to any comments; however, they did consider them when making a final scoping decision and moving onto the draft environmental impact statement (DNR, 2016).

Following the scoping phase came the beginning of the environmental review process and the draft environmental impact statement. The DNR released the DEIS in 2009 and held two public hearings on the document and had the comment period open for ninety days. Over the two public hearings and ninety-day comment period, the DNR received 3,822 public comment submissions (DNR, 2016). The EPA, which must review all federal EIS decisions per 42 U.S. Code § 7609, ultimately deemed the DEIS as inadequate. The EPA's inadequacy rating, along with other changes in the EIS by PolyMet, led to an uncommon occurrence of a supplemental draft environmental impact statement.

According to the DNR, there were three reasons for a supplemental draft impact statement (SDEIS). First was the EPA's inadequacy rating of the DEIS; the second was because of the addition of a federal land exchange between PolyMet and the US Forest Service; and the third was because PolyMet made other significant changes to their project that required additional environmental review (DNR, 2016). Interestingly, there are no state legal requirements for state agencies to create a supplemental draft environmental impact statement; there are only state laws regarding supplemental final environmental impact statements (see Minn. R. § 4410.3000). Although state agencies do not need to create an SDEIS, under federal law, agencies are permitted to establish one (see 40 CFR § 1502.9). Since the PolyMet project is on both federal and state land, this law applies to the mining proposal. The DNR and now two federal agencies—the US

Army Corps of Engineers (ACOE) and the US Forest Service (USFS)—now had the opportunity to amend and supplement the DEIS. The agencies held three public hearings in 2014 and had a ninety-day comment period of the SDEIS (DNR, 2016). The three public hearings and ninety-day comment period resulted in nearly 58,000 public comment submissions (Phadke, 2018; DNR, 2016). Following the comment period, the agencies accepted the SDEIS in 2013 (DNR, 2016).

After the approval of the SDEIS, the decision-making agencies created a final environmental impact statement (FEIS). The FIES incorporated all previous comments from the DEIS and SDEIS and solicited additional public comments on the substance of the FEIS before releasing a record of decision (ROD) leading to the permitting phase (DNR, 2016). The ROD is the final decision by the DNR, where the agency either outright accepts or rejects the EIS or requires a supplemental FEIS to amend any flaws (see Minn. R. § 4410.2800). Before issuing the ROD, the DNR opened the FEIS for public comments for forty-two days—thirty-two days longer than legally required (see Minn. R. § 4410.2800)—and received over 30,500 public comment submissions. When reviewing public comments, the DNR under state law did not need to respond to the public comments; they only needed to collect and review them without showing the public their process (see Minn R. § 4410.2800). However, the DNR did respond to and reviewed all FEIS public comments as they did in the DEIS and SDEIS phases. If any of these public comments raised concerns or led to significant changes in the FIES, the DNR could require a draft FEIS in their ROD (see Minn. R. § 4410.2700). However, the DNR, through their review of comments, deemed the FEIS as adequate, which led to the permitting phase.

PolyMet needed three key state permits and one federal permit to begin construction. The three state permits were the Permit to Mine issued by the DNR and the water and air quality permits issued by the Minnesota Pollution Control Agency (MPCA). The one federal permit was the Section 404 permit, issued by the ACOE. The federal Section 404 permit did not have a comment period, but instead, the ACOE reviewed nearly 17,000 submissions from the state's SDEIS public comment period before accepting the permit March 2019 (ACOE, n.d.; Karnowski, 2019). For the state permits, the DNR and the MPCA jointly held two public hearings and collected public comments at the same time, which led to nearly 12,000 public comment submissions on the Permit to Mine and 700 for the water and air quality permits (DNR, 2018b; MPCA, 2018). Ultimately, because of stringent state requirements on what a substantive comment is for the Permit to Mine (see Minn. R. § 6132.4000, subpart. 2), the DNR announced that zero of the 12,000 comment submissions were substantive and, therefore, did not require a response and influenced no changes to the Permit to Mine (DNR, 2018b). Finally, as of December 20th, 2018, the MPCA finished reviewing and finalizing their respective permits, reviewing over 700 public comments. These five phases have resulted in nearly 105,000 public comment submissions over fifteen years.

2.2 Federal and Minnesota Participatory Policies

The PolyMet project takes place on both federal and state land, and, therefore, both federal and state environmental and participatory policies regulate environmental review and citizen engagement. More specifically, in Minnesota law, when any project requires environmental review at the state and federal level, the state decision-making agency—also known as the responsible governing unit (RGU)—works with the federal agencies to

reduce the duplication of review under the National Environmental Policy Act (NEPA) and the Minnesota Environmental Policy Act (MEPA) (Minn. R. § 4410.3900, subpart 1).

The origin of public participation requirements at the federal and Minnesota levels stem from the Administrative Procedure Act (APA) and the Minnesota Administrative Procedure Act (MAPA), respectively, and are important frameworks for environmental policies that require citizen engagement. The APA is the oldest of the federal policies that regulate public participation. Congress adopted the APA in 1946, which introduced a structured process for federal agencies to propose changes to rules and regulations (Beierle & Cayford, 2002). At a basic level, the APA requires public notice about proposed rules and information on how decision-makers create those proposals and provides an opportunity for the public to comment on them (Beierle & Cayford, 2002). Similarly, in Minnesota, the MAPA, adopted in 1945, increases the public access to information and allows for public participation in administrative rules by requiring public hearings on state-made decisions (Beck, 2014). The APA and the MAPA lay out the baseline regulations for public transparency and public participation in administrative decisions and have influenced numerous other policies, including the National Environmental Policy Act and Minnesota Environmental Policy Act, which are the two most prominent environmental policies that ensure public participation at the federal and state level.

Minnesota passed the Minnesota Environmental Policy Act (MEPA) in 1973 with the overall purpose of conserving the environment, preventing environmental harm while promoting economic growth, and to continually learn about the state's natural resources and opportunities (Minn. Stat. § 116D.01). Under Minn. Stat. § 116D.04, MEPA lays out

the basic requirements of environmental assessment, noting the need for an environmental impact statement where a proposed project will have significant effects on the environment caused by any significant government action. In conjunction with the MEPA guidelines for determining if an environmental impact statement is necessary, the state has administrative rules that establish the guidelines for what belongs in an environmental impact statement (see Minn. R. § 4410.0200-.6500). Under this administrative rule, the environmental impact statement process should ensure that human actions do not adversely impact the environment as well as provide the public to participate in the environmental review and decision-making processes (Minn. R. § 4410.0300).

Similarly, the National Environmental Policy Act (NEPA), which Congress passed in 1969, established new rules and regulations to promote environmental quality in federal decisions. Some of NEPA's most powerful regulations included the requirements for federal agencies to conduct environmental assessments and environmental impact statements and the availability for the public to comment on those statements (Dreyfus & Ingram, 1976; Halvorsen, 2006). The purpose of environmental impact statements under NEPA is to provide all information about the environmental impacts of federal projects and must review all other alternatives that would reduce environmental impact (40 C.F.R. §1502.1). The public commenting rules under NEPA as similar to MEPA, requiring comments be specific, polite, and technical.

2.3 Requirements for Public Comments on the FEIS

Table 2.2 about here

Under Minnesota Administrative Rules, once the decision-making agency releases its environmental impact statement, there is a ten-day public comment period (Minn. R. § 4410.2600-.2800). In the case of the PolyMet mine proposal, the DNR as the decision-making agency extended the comment periods of all the environmental impact statements to over 30 days. Following the decision-making agency's collection of public comments, the agency must review them and determine what comments are substantive enough to respond to that may make changes to the environmental impact statement documents (Minn. R. § 4410.2600-.2800). Although Minnesota rules state that the DNR must respond to substantive comments, the state has no legal definition for what a substantive comment is. Instead, Minnesota's Environmental Quality Board made up of nine state agencies and eight citizens whose duty is to study environmental issues and ensure environmental compliance—has de facto rules about what makes a substantive comment (summarized in Table 2.2 in Appendix B). According to the Environmental Quality Board, substantive public comments:

1. Point out inaccuracies in the document;
2. Discuss and prove other environmental issues not yet discussed;
3. Discuss and prove that the environmental issues mentioned were not adequately addressed;
4. Or discuss other mitigation methods that the decision-making agency should include in the document (EQB, n.d.).

Under the Environmental Quality Board's guidelines, agencies typically consider comments that do not meet these requirements and that are crass, rude, or general statements of support of opposition as nonsubstantive (EQB, n.d.).

Regarding the DNR's requirements for substantive comments, they provided additional suggestions for substantive comments on the FEIS (summarized in Table 2.2). These suggestions include:

1. Comments on whether the DNR and FEIS analyzed topics identified in the scoping and environmental review phases of the PolyMet project;
2. Comments on whether the DNR adequately responded to public comments on the SDEIS;
3. Finally, comments on whether the DNR followed the legal requirements for preparing an EIS under federal and state regulations (DNR, n.d.).

Regarding the comments on the FEIS, the DNR, needed to collect and consider these comments, but unlike the previous EIS phases, the agency did not need to respond to them (DNR, 2016; Minn. R. § 4410.2800). However, the DNR did respond to all substantive comments, following similar coding rules for the previous comment periods (DNR, 2016).

3 Literature Review

I use the evidence-based policy research (EBP) literature to examine the DNR's use of public comments as evidence. As Head (2010a) reviews, EBP scholars have explored the benefits of using scientific evidence to better inform decisions (Head, 2010a). However, the use of public comments also highlights some of the potential pitfalls of evidence-based policymaking. Some of these flaws include a researcher's and policymaker's policy analytical capacity; bounded rationality; the difficulty of using complex data; how researchers and policymakers may manipulate evidence; and how political differences influence decisions (Botterill & Hindmoor, 2012; Haas, 1992; Head, 2008; Howlett, 2009; Juntti, Russel, & Turnpenny, 2009; Newman & Head, 2015).

While these flaws may hinder the effectiveness of evidence-based policymaking, incorporating multiple types of knowledge may help address some of these flaws to help make better decisions. In this chapter, I discuss the purpose of evidence-based policymaking, some of its flaws, and, finally, how the definition of evidence-based policymaking is beginning to incorporate multiple types of knowledge.

3.1 What is Evidence-Based Policymaking and Why use it?

When policymakers and public administrators make decisions, their goal is to make those decisions with the best available knowledge of "what works" (Head, 2008, 2015). In the last few decades, the idea for more reliable knowledge in decision-making processes has grown, leading to a rising discussion of evidence-based policymaking. By the 1960s and 1970s discussion for evidence-based policymaking had grown with the need for rigorous science to provide accurate advice on policy decisions (Head, 2010a,

2010b, 2015; Juntti et al., 2009). By the late 1990s, the call for evidence-based policymaking increased when British Prime Minister Tony Blair and his staff began to utilize and discuss knowledge as evidence to make sound policy decisions (Botterill & Hindmoor, 2012; Head, 2008, 2010a; Kay, 2011). Head (2010b) argues that evidence-based policymaking only works in democratic countries such as England, where there is a political culture that is sTable and aims to provide transparency and rational reasoning throughout the policy process. Federal and state agencies in the United States have also increased their focus on evidence-based policymaking (Hall & Jennings, 2010). Hall and Jennings (2010) highlight, for instance, that federal and state policies have increasingly required or suggested the use of evidence in policymaking to increase accountability and policy success. All agencies, however, do not incorporate evidence into decisions in the same way, which leads to an inconclusive and malleable definition of evidence-based policymaking (Hall & Jennings, 2010). Cairney (2016b) points out that we still lack an empirical knowledge of evidence use in environmental policymaking in the United States.

3.1.1 Defining evidence

Although there is no one definition for what evidence is in evidence-based policymaking, many scholars broadly define it as the collection and use of reliable, rigorous, and rational knowledge to create effective, efficient, and accurate policies and decisions throughout the policy process (Botterill & Hindmoor, 2012; Clarence, 2002; Head, 2010a). With this definition, the evidence speaks for itself and is meant to provide neutral, unambiguous, and substantive scientific information of "what works" to make and influence decisions at each of the five stages of the policy process (Kay, 2011; Lin,

2008; Newman & Head, 2015). Agencies are supposed to use the "best evidence for the situation," which means the highest quality knowledge that is credible and trustworthy, which typically places different types of knowledge into hierarchies, where technical scientific knowledge from the physical and biological sciences is at the top (Mullen, 2018). This primary focus on these types of sciences over the social sciences such as anthropology or sociology or values-based knowledge stems from the belief that technical sciences provide more concrete information based on quantitative methodologies, reducing the uncertainty of policy problems (Cairney, 2019; Cairney, Oliver, & Wellstead, 2016; Head, 2008). However, the literature on evidence-based policymaking and knowledge types increasingly acknowledge that incorporating different types of knowledge—something that the public comments from the PolyMet provide an array of—may improve evidence (Head, 2010a) and that knowing what works best given the situation will also improve policy decisions (Campbell, 2002).

3.2 Flaws and Difficulties of EBPM

Although evidence-based policymaking provides the opportunity for decision-makers to use research in the policy process, several flaws hinder how decision-makers use evidence. Newman, Cherney, and Head (2017) mention three core flaws: first, the political manipulation of data where people will use data as a tool to support their agenda; second, the miscommunication, representation, and understanding of data by researchers and decisionmakers; and third, the fact that political and cultural differences make data interpretation challenging. The authors also note that a fourth potential difficulty with evidence-based policymaking is the insufficient policy analytical capacity of agencies to access, interpret, and apply different forms of knowledge and information

into the decision-making process (Newman et al., 2017). One final difficulty of evidence-based policymaking is that sciences and research are "boundedly rational," meaning that values, beliefs, political perspectives, and more influence one's research and decisions (Botterill & Hindmoor, 2012).

3.2.1 Convoluted data, epistemic communities, and power

As Botterill & Hindmoor (2012) state, a researcher may distort their data when presenting it to a decision-maker by oversimplifying evidence in hopes of making it clearer. On the one hand, while some researchers may oversimplify their research, other researchers may use too much jargon, making it difficult for policymakers to understand (Botterill & Hindmoor, 2012). Flitcroft et al. (2011) in their study of evidence in cancer policies, for example, noted that researchers and decision-makers working together is difficult, primarily through the filtering of evidence to make meaningful contributions to decisions. Along with researchers oversimplifying or complicating data, Head (2010b) notes that quite often decision-makers are not equipped with the knowledge to understand scientific reports and, therefore, may refrain from fully engaging with the data, which means that they might misuse the scientific data or give too much power to what scholars call an epistemic community.

An epistemic community consists of professionals with expertise in a given field who are authorities in their field and have a more significant influence on policy decision (Haas, 1992). In environmental decision-making, such as with the PolyMet mine, epistemic communities with the scientific expertise to validate their research to decision-makers who may misunderstand the technical details may hold higher power than others in the decision-making process (Litfin, 2000; Zito, 2001). Especially on environmental

issues larger in scale, decision-makers may rely on these epistemic communities to answer their questions of uncertainty, which, ultimately, allows these communities to frame problems and influence decision-makers (Zito, 2001). These situations give these epistemic communities the power to drive the decision-making process, where decision-makers ultimately conform to the uncertainty created by these communities (Haas, 1992).

3.2.2 Political Manipulation

While decision-makers may often not have a scientific understanding of all data and may be influenced by epistemic communities, they must still use such data to fulfill policy agendas. Scholars have shown that if particular research supports the preferred outcome of the decision-maker, they will handle that research differently in policymaking (Black, 2001; Clarence, 2002; Haas, 2004; Hall & Jennings, 2010; Head, 2013). For example, if the Environmental Protection Agency (EPA) conducted a study on water quality, and it proves or benefits the point of a decision-maker, they will likely present the entire study from the EPA. However, if that research does not support or only slightly supports a decision maker's preferred outcome, they may ignore or selectively use and cherry-pick favorable research data (Black, 2001; Clarence, 2002; Head, 2010b, 2016; Weiss & Gruber, 1984). These are two ways that some scholars suggest that decision-makers strategically use and weaponize knowledge, whether or not they wholly understand the data as evidence to gain and maintain power in government (Owens, 2005; Weiss & Gruber, 1984). Critics of evidence-based policymaking note that research as evidence is not just about providing the best available knowledge to make decisions anymore, but instead a way to manipulate the policy process (Newman & Head, 2015). The political manipulation of evidence to inform the policy process may also be prevalent

in the PolyMet case study. For example, although the permitting process is not in the scope of this thesis, the MPCA's mishandling of EPA comments on the water quality permit may demonstrate the agency's manipulation of public comments as data by hiding valuable comments that challenge the agency's decision.

Additionally, in participatory or deliberative attempts to include citizens in the decision-making process, decision-makers may only use citizen or value-based knowledge to legitimize decisions rather than improve them; it is purely a symbolic gesture to further gain power by making their constituencies happy by showing them they are involved in these processes (Head, 2010b; Juntti et al., 2009; Radaelli, 1995). The PolyMet FEIS phase, because of the interpretive laws on public comments, provides the DNR the opportunity to easily meet the requirements of state and federal policies, but in this case, the agency went beyond the laws to respond to all substantive comments (DNR, 2016). This inclusion may have been symbolic posturing by the DNR, or it may have influenced the decision-making process. Head (2016) and Majone (1989) point out that when these symbolic gestures occur, evidence can still inform debates and media discussions as the PolyMet mine has done—suggested by the increased public participation in the project—but do not drive the outcome. This focus on evidence only informing instead of making policies and decisions begins to highlight the policy analytical capacity of policymakers and decision-makers.

3.2.3 Political differences influence decisions

One of the key concerns in the EBP literature is the intersection between politics and scientific practice. Haas (2004) reminds us that science is not objective knowledge and that it represents the implicit values of the researcher. In one sense, for instance, science

is political because of its consequences of benefiting some and not others, particularly while researchers and decision-makers do not work with all of those potentially impacted by decisions (Haas, 2004; Lidskog & Sundqvist, 2002). Further, decision-makers base their policy processes on political values and negotiations and, therefore, certain types of evidence are more relevant to decision-makers than others (Head, 2016; Majone, 1989).

Additionally, while citizen knowledge is essential to making sound decisions, reviewing and navigating the belief- or value-based knowledge of the public has several challenges. First, when public managers are making decisions that have a lot of strong opinions from the public, there is a more considerable controversy (Cairney, 2016b; Head, 2010a). On issues that are large or controversial and have no single solution, opponents or proponents of a potential decision may use research and knowledge as a weapon—similarly to decision-makers—to create a narrative to make their point more valid and gain support for political purposes (Cairney, 2016b; Head, 2010a). This weaponization detracts from the decision-making process and reduces the usefulness of deliberative evidence-based processes (Head, 2010a, 2016).

Evidence use, then, in a highly conflicted and politicized decision-making process, can create the worst possible choices because they overwhelm the processes that agencies have set up to make effective decisions (Turnpenny et al., 2008). So-called "wicked problems"—where there is no one agreed-upon solution because stakeholders perceive the world differently and have different frames for understanding a problem (Rittel & Webber, 1973)—are especially prevalent in environmental decision-making (see Cairney, 2016b). These wicked problems commonly found in environmental policy are also prevalent in the decision-making process over the PolyMet mine, especially in the DNR's

collection and analysis of public comments, where the agency received nearly 100,000 public comments (figure 2.1). These public comments demonstrate not only the massive scale of this project but also the political divide on it, which means that any decision the DNR makes on the mine will inevitably seem like a poor decision to many people.

3.2.4 Policy analytical capacity

One fundamental difficulty with evidence-based policymaking is an agency's or policymaker's policy analytical capacity. Policy analytical capacity refers to the education, experience, and expertise of agency employees to conduct analysis on certain policy topics as well as the level of technical ability and organizational culture of an agency to create and distribute policy research (Howlett, 2009; Wellstead, Stedman, & Howlett, 2011). This capacity often challenges an agency's ability to conduct and review research because they may lack the expertise and training, technical abilities, or organizational culture or structure to handle conduct and analyze research, which may negatively impact decisions (Howlett, 2009, 2015; Newman et al., 2017; Wu, Ramesh, & Howlett, 2015). Although policymakers and decision-makers have large teams to help make decisions, time, resources, legal requirements, finances, political agendas, expertise, and other constraints limit the use of evidence in the decision-making process (Botterill & Hindmoor, 2012; Howlett, 2009; Newman et al., 2017).

Additionally, public agencies are organized in different policy domains such as environmental regulation or economic development with different organizational types with different functions, such as oversight, policy development, or service delivery, and may also have different analytical capacities to handle research (Head, 2016; Howlett, 2015). Howlett (2015) notes, for example, that financial agencies rely more heavily on

quantifiable research, which decision-makers often consider more reliable. On the other end, Howlett (2015) notes that when agencies use less quantifiable research, other researchers and decision-makers often challenge their data, and they have fewer resources to conduct or analyze research data. These capacities of decision-making agencies may also influence how the DNR treats public comments on the PolyMet proposal. Given that the mine involves environmental and social issues, the DNR may have a lesser capacity to analyze public comments. Further, given the spike of public comments from the scoping period to the DEIS (figure 2.1) and the lengthy environmental review process, the DNR may not have had the analytical capacity to handle all of those public comments.

When decision-makers such as the DNR use evidence-based policymaking to make and influence decisions, there is not always one best type of knowledge to use. Decision-makers may need to focus on the different knowledge types to use as evidence rather than looking for the perfect type of scientific evidence to make decisions (Howlett, 2009). Decision-makers must acknowledge their capacity to review evidence as well as under what circumstances different types of knowledge are most important in making decisions (Head, 2015, 2016; Newman & Head, 2015).

3.2.5 Bounded rationality

Technical science is not an apolitical form of knowledge. Instead, it is "boundedly rational," meaning that there is no way to separate the ambiguity from science (Botterill & Hindmoor, 2012; Cairney, 2016a, 2019; Cairney et al., 2016; Kay, 2011). In the policy process, bounded rationality is the concept that decision-makers cannot examine all information to make decisions; they turn complex problems with multiple definitions and

solutions into one explanation (Cairney, 2019). In this bounded rationality—while trying to make the most apolitical decision given a limited capacity to review all information—it is not possible for a decision-maker to separate values, beliefs, political pressure, and more from objective scientific methods, research, and evidence (Botterill & Hindmoor, 2012; Cairney, 2019; Kisby, 2011; Newman & Head, 2015).

Not only are decision-makers and policymakers influenced by bounded rationality, but researchers are as well. Ludwik Fleck (1935) notes that once researchers present their results, they begin to embed their belief systems into those results, no matter how minor. Even during the research design and methodology phases of studies, researchers have bounded rationality. In deciding how to conduct research, scientists often perpetuate their belief systems on how they believe one should conduct a study or the best types of methods to achieve the results that fit their needs most (Head, 2010b). Although the idea of technical science itself is rational and apolitical, those who conduct it and those who make policy decisions from that data are not purely rational; they base their decisions on norms, beliefs, politics, and more (Head, 2010b).

3.3 Embracing Other Types of Knowledge

Although decision-makers traditionally see scientific knowledge as more rigorous in producing sound evidence for decisions, EBP scholars increasingly agree that other forms of knowledge should play a role in legitimizing decisions (Botterill & Hindmoor, 2012; Clarence, 2002; Head, 2010a). While scientific evidence is essential to reduce scientific uncertainty, researchers and decision-makers should embrace the ambiguity—values, beliefs, and emotions—of such knowledge (Botterill and Hindmoor, 2012). Doing so may help gain support for policies and decisions by policymakers and decision-makers from

researchers and by citizens from decision-makers (Cairney et al., 2016; Grundmann, 2017). Scientific evidence is not enough to persuade and justify its use without other knowledge considerations (Mullen, 2018). Politics, beliefs, and values influence scientific knowledge and, therefore, should factor in social sciences and other forms of knowledge to effectively make decisions for society (Lidskog & Sundqvist, 2002; Sanderson, 2009). Decision-makers must also consider if their decision will work in that specific location; does it work here and why and will it continue to work in the future (Mullen, 2018)? Science only works well when we acknowledge the other forms of knowledge that help determine if a given policy decision is the right choice.

Clarence (2002) and Head (2010b) note that decision-makers value technical quantitative data to a point where they focus solely on that data over other forms of knowledge. However, in a world where decisions are made up of facts, norms, values, and beliefs, there is no one type of knowledge base to make up evidence (Head, 2015). Clarence (2002), for example, reminds us that evidence is not wholly rational and apolitical and that opinions, concerns, and layperson knowledge should also factor into decisions to create the most effective decision for all people. Therefore, it is essential that decision-makers not only focus on scientific evidence but also on the values-based ambiguous information that guides people in interpreting information in different ways (Cairney et al., 2016). However, when decision-makers consider what knowledge types provide the most useful information, they often focus on scientific knowledge.

Head (2008), Maddison (2012), and other scholars highlight the important knowledge types outside of technical sciences as professional knowledge, political knowledge, citizen knowledge, and indigenous scientific knowledge. Decision-makers

should not view these types of knowledge as irrational, but rather a practice of practical rationality to help make decisions beyond "what works" by also considering what is most appropriate (Sanderson, 2002, 2009).

3.3.1 Different types of knowledge

Along with scientific knowledge, professional, political, and citizen knowledge are important to evidence-based policymaking and public comments in particular. First, professional knowledge includes public and program managers and those who deliver other services that often have the most experience dealing with people and knowing how policies and decisions affect them (Head, 2008, 2010a, 2010b). On-the-ground practitioners, such as environmental educators, tourist guides, or public managers in the areas of the proposed PolyMet mine, provide a type of knowledge that decision-makers and policymakers do not have by being on the ground, experiencing and implementing policies and decisions. By experiencing and implementing these policies, they have a more lived and ethnographic knowledge system than, say, biological or physical sciences that are more detached from qualitative knowledge and lived experiences (Head, 2010b, 2015).

Professional knowledge may also include street-level bureaucrats, who are public service works such as teachers or police officers who work directly with citizens who have discretion over their own decisions but who also witness first-hand how policy decisions impact communities (Meyers & Vorsanger, 2007). Rather than a top-down approach of policymakers dictating the actions of street-level bureaucrats, a bottom-up approach where they provide their input into the decision-making process may be vital in implementing and changing decisions (Maupin, 1993). Because of a street-level

bureaucrat's intimate experience with the public, their potential influence on policy decisions provides decision-makers with valuable knowledge of "what works" for all people (Peters, 2015).

The second type of knowledge is political knowledge, which includes the partisan tactics of political leaders to define problems and set agendas to fit a politician's agenda (Head, 2008; 2010a, 2015). This type of knowledge typically involves spin of other types of knowledge, such as biological or physical science, to build support from constituents and other policymakers (Head, 2010a, 2010b). Here, political knowledge focuses more on knowing how to navigate the policy process and using evidence to gain support (Head, 2008, 2015) more so than creating new qualitative and quantitative data. While politicians and political knowledge have played a role in supporting or opposing the PolyMet mine, for instance, they do not always provide public comments at every stage of the public commenting process. However, their input in the media and through other mediums help promote a particular agenda in support or opposition of the PolyMet project. Although political knowledge may seem more partisan and, therefore, undesirable in evidence-based policymaking, it may still help those with professional, citizen, indigenous scientific, or other forms of knowledge navigate the political system to help influence decisions.

Along with knowledge from professional groups, politicians, and scientists, citizen knowledge may be necessary for providing the most accurate policy decisions and is the most common type of knowledge from public comments. Campbell (2002) discusses that there is a disjuncture between scientific evidence and local knowledge that creates tension between researchers and citizens. Although citizens hold a distrust that

researchers can solve their problems, decision-makers have tended to focus solely on scientific research to make decisions (Callon, 1999; Clarence, 2002). Head (2010a, 2015) discusses that actors and other citizens may hold different viewpoints on potential policy decisions than scientists or public administrators that may strengthen those choices. Citizen knowledge is an important form of knowledge because of a citizens' abilities to legitimize decisions and improve the transparency of decision-makers, which helps bring together policy decisions and evidence by showing and validating the process of how decision-makers use evidence to inform their choices (Juntti et al., 2009; Radaelli, 1995; Yearley, 2006).

Decision-makers are increasingly focusing on citizen knowledge because, in order to implement policy decisions that benefit all people and the environment, they should know how those decisions might affect the public (Head, 2010a, 2015), such as those who live near or downstream from the proposed PolyMet mine. Best, Hiatt, and Norman (2008) help solidify this idea of including the public more in evidence-based policymaking and knowledge creation by discussing the knowledge integration model. Knowledge integration is the incorporation of knowledge into decisions (Best et al., 2008). Best et al. (2008) note that although public influence in decisions is currently non-systematic, it should be something that decision-makers focus on to establish the most effective decisions and policies for all people.

Dobrow et al. (2004) citing Champagne (1999), Langley et al. (1995), Lomas (2000), and Weiss (1983) discusses that decision-makers often overlook participants such as citizens in decision-making processes, but that they are often important in defining what constitutes evidence and how decision-makers review it. Citizens bring in their own

experiences, beliefs, and values that highlight issues that researchers and decision-makers may have not otherwise considered. They can also help legitimize decisions, and can ultimately alter the entire decision-making and evidence-based processes (Dobrow, Goel, & Upshur, 2004; Jung, Korinek, & Straßheim, 2014; Murdock, 1994; Papadopoulos & Warin, 2007). In many potential decisions, they may often have a better understanding of "what works" because of their lived experiences and value- and belief-based knowledge.

3.3.2 Indigenous Scientific Knowledge

Traditional Ecological Knowledge or TEK is a knowledge system defined as "the relationship of living beings to one another and to the physical environment, which is held by peoples in relatively nontechnical societies with a direct dependence upon local resources (Kimmerer, 2002, 1-2; citing Berkes, 1993). TEK has developed over generations, and it is both reliable and rational. While policymakers often ignore TEK, scholars argue that it should have equal status with other forms of scientific knowledge because of indigenous people's understanding of the environment and science that provides a different perspective than technical sciences (Kimmerer, 2002; Mauro & Hardison, 2000).

TEK has important commonalities with other sciences. Both forms of knowledge and knowledge production are systematic and provide detailed data (Kimmerer, 2002). Where TEK and technical sciences differ is part of the reason why TEK is a vital knowledge type to help make decisions. A critical difference that Kimmerer (2002) points out is that TEK methodologies tend to be qualitative, and those conducting studies are often resmyce users such as hunters, fishers, and gatherers. Unlike technical sciences, TEK transcends empirical data collection and embraces the social connections of nature and

culture (Kimmerer, 2002). Where technical sciences have traditionally focused on being value-free, TEK incorporates values into its data and may provide more significant insights alongside technical sciences by understanding the cultural and spiritual values of the resmyces TEK researchers study.

Although policymakers, decision-makers, and researchers are increasingly valuing TEK and including tribal governments early on in the decision-making process—such as the tribes on the 1864 Ceded Territory where the PolyMet mine would reside (map 2.1)—some policymakers still express bias against TEK and other indigenous sciences, stating that they are not as rational and influential as technical sciences (Mauro & Hardison, 2000). Maddison (2012), for example, discusses evidence-based policymaking and indigenous Australian peoples, where policymakers have ignored indigenous knowledge, which ultimately leads to less-informed and racialized policies. In the PolyMet mine case study, the tribal governments had been included early and often in the decision-making processes, but they have continually noted that their expertise has been ignored or mishandled by the DNR. Maddison (2012) and Mauro and Hardison (2000) state that increasing indigenous and voices and knowledge in decision-making processes at every part of the process will help create more equitable policies and decisions for all people.

3.4 Justification for EBPM

Although there are theoretical and empirical studies and discussions on evidence-based policymaking in the environmental field, few studies focus on environmental policy and evidence-based policymaking in the United States (Cairney, 2016b). So although there is a large body of literature on evidence-based policymaking that demonstrates the purpose, flaws, and growth of evidence and the use of different types of

knowledge in environmental policy globally, there is still more that scholars can study about this field in the United States. This thesis will add to the empirical literature on evidence-based policymaking and knowledge use in environmental decision-making in the United States. It will provide specific insight into some of the flaws of evidence-based policymaking, including how controversial environmental decision-making processes such as the PolyMet mine often confounds capacity of decision-makers to use evidence-based policymaking as well as how decision-makers value different types of knowledge.

4 Data and Methods

To answer my overall question of how the DNR values and uses public comments as evidence to influence their decisions on the FEIS, I asked four sub-questions:

1. Was the DNR more likely to code a certain type of knowledge as substantive?
2. Was the DNR more likely to code certain groups of organizations or people with different types of knowledge as substantive?
3. Was the DNR more likely to code comments from those who opposed the mine as substantive?
4. Was the DNR more likely to code certain themes or issues brought up in comments as substantive?

I asked these four questions because they break these public comments into different ways that may help explain how the DNR valued public comments. By examining groups, sentiment, and themes and including knowledge type to answer these questions, I can better provide a definition of what evidence is to the DNR, what type of knowledge the agency values most, if they held any biases, and if they faced any challenges to using these public comments as evidence. To answer these questions, I used the DNR's coding of substantive comments and their coding of different themes on the FEIS as well as my coding of these comments into different groups and based on sentiment.

With these different types of coding, I used content analysis to quantify these nominal variables to analyze knowledge type by substantive coding. Then, I analyzed represented groups by knowledge type and then by substantive coding. Third, I analyzed public comments based on sentiment by knowledge type and then by substantive coding.

Finally, I took the DNR's themes and analyzed them by knowledge type and substantive coding. In these four analyses, I examined how knowledge type and substantive coding frequencies compare to each other.

Because of the different laws and regulations that guide public commenting for the different phases of environmental review and permitting in Minnesota, focusing on multiple phases of the PolyMet project was outside of the scope of this project. I ultimately focused on the FEIS for three key reasons. First, when narrowing down which phase to focus on, I wanted to examine a public comment period with many public comments and where the DNR had already made a final decision. Even if taking a sample, a larger number of public comments would allow me to best analyze how the DNR valued different types of knowledge as evidence because there is a larger array of issues discussed. Additionally, a phase where there the DNR already made a final decision made my analyses more possible. Without a decision from the agency, I would have had more trouble examining how and why the DNR coded comments the way they did that led to their outcome. Because of the smaller number of public comment submissions on the other phases and that the permits are currently under legal scrutiny, I chose between analyzing the Supplemental Draft Environmental Impact Statement (SDEIS) and the Final Environmental Impact Statement (FEIS). I chose the FEIS because a graduate student in Minnesota conducted a similar public comment analysis on the SDEIS and found it better to focus on the phase that nobody had studied yet.

Using the FEIS, I used the DNR's breakdown of public comments from the 30,539 submissions they received. Here, a comment submission is the entire document that one submits to the DNR regarding the FEIS. The DNR then breaks those submissions up into

different themes and issues to respond to rather than provide one response for a single submission. Therefore, there can be multiple public comments within a submission.

I then took a random sample of the 30,539 submissions the DNR received. To get a representative number, I removed all duplicate documents, which included form letter non-variants. These form letters are letters or petitions written by one group that a citizen signs and sends to the DNR without making and changes to the document. I found that 29,362 of the submissions were form letter non-variants and came from nine groups. Instead of including ever non-variant form letter in my analysis, I only analyzed the nine unique form letters. Removing the form letter non-variant submission still left me with 1,177 submissions to sample from. At ninety-five percent confidence and a five percent margin of error, I analyzed 300 submissions—a random sample of 291 plus the nine form letters. Of the 300 submissions, the DNR broke those into 1,715 comments. To analyze these comments, I conducted inductive and deductive qualitative coding and content analysis laid out in Udo Kuckartz's (2014) book on qualitative methods to quantify the public comments and look for patterns on how the DNR might have coded comments as substantive and, therefore found more valuable, and the type of knowledge different groups, themes, and sentiment provide.

4.1 Content Analysis

Content analysis is the quantification of qualitative data to look at the meanings and relationships of words from texts (Kuckartz, 2014). In this thesis, I quantify the substantive coding, knowledge types, groups, sentiment, and themes from my sample of public comments to analyze where there might be relationships in knowledge type and substantive DNR coding. Content analysis can help identify the intentions, behaviors, and

coding patterns of texts (Kuckartz, 2014), and because my goal of this thesis was to compare the DNR's coding of different knowledge types based on how they counted comments as substantive, this type of analysis helps me understand the relationships between these variables as well as infer intentions and limitations of the DNR when using evidence-based policymaking.

4.2 Defining, Coding, and Analyzing Knowledge Type

For different knowledge types, I defined the different knowledge sources of scientific, citizen, political, professional, and indigenous knowledge discussed in chapter three into two categories: expert and layperson knowledge. Expert knowledge consists of scientific knowledge such as biological, physical, or ecological and technical expertise a given issue. Layperson knowledge primarily includes citizen-based knowledge, but may also include political, professional, or indigenous types of knowledge and is based on values, beliefs, politics, and lived experiences, and anecdotal information. While expert knowledge consists of the scientific and more technical knowledge that decision-makers have historically used, I found limitations in defining layperson knowledge. Because of the nature of public comments to provide citizen knowledge, I could not easily infer professional, political, or indigenous types of knowledge to place them into their own categories. These four knowledge types blend throughout public comments, so I chose to combine them all together. However, in doing this, I lost some of the intricacies of each knowledge type, and most of these layperson comments focus on citizen-based knowledge.

Using these definitions of expert and layperson knowledge, I used NVivo to review each of the 1,715 public comments and used deductive coding to define each comment as

either expert or layperson knowledge. Deductive coding is a top-down approach, where I used my pre-set definitions of expert and layperson knowledge from the evidence-base policymaking literature and read through each public comment and placed it into its respective knowledge type. To ensure accuracy, following this coding, I went through each comment and code twice more to ensure that I put comments into the correct knowledge type.

Using this coding, I created three figures to look at knowledge type and substantive coding. First, I show the frequency of expert and layperson knowledge and then the frequency of the DNR's substantive coding. I then combined these two frequencies to know what percent of expert and layperson knowledge the DNR coded as substantive. Doing this analysis helped to know the DNR's overall value of public comments based solely on knowledge type.

4.3 Coding and Analyzing Groups

I analyzed these knowledge types and substantive coding further by adding the different represented groups. Adding this variable helped to demonstrate any potential bias towards a group of commenters as well as helped me further infer the DNR's value of expert and layperson knowledge by how they code comments as substantive. To define the different groups, I used inductive coding methods. Using this bottom-up coding technique, I reviewed the 300 submissions using NVivo. For this coding, I did not need to review each public comment because first, not every comment included a stated affiliation to a group, and second, it would be redundant to analyze each comment since there are only 300 unique individuals.

In defining these groups, I went through each submission and coded in vivo (Kuckartz, 2014)—the exact words—the stated group or organization from a commenter. If a commenter provided no stated affiliation, I coded them as a citizen. For those in vivo codes of organizations, I went through each one and combined them into similar groups. For instance, if there were four environmental organizations providing public comments, I placed them into an "Environmental Group" code. For those commenters that stated no affiliation and that I coded as citizens, I further broke them up into "Citizens Opposed" and "Citizens Supporting." To dichotomize the citizen group, I used my coding of sentiment described in section 4.4 to create a frequency table in NVivo of citizens by support or opposition.

Following my coding of groups, I then created figures using my coding of knowledge type and the DNR's coding of substantive comments. First, I look at the type of knowledge—expert or layperson—that a group provides. Second, I examined how the DNR coded different groups' comments as substantive. With these figures, I compared the frequency of knowledge type to the substantive coding to know if certain groups and the knowledge the provided had more value to the DNR through the percent of substantive public comments.

4.4 Coding and Analyzing Sentiment

I also used knowledge type and substantive coding to see how the DNR valued comments based on sentiment. This helped to know if the DNR held any bias against those who support or oppose the PolyMet project despite the type of knowledge that the comments provided. To code these comments based on sentiment, I defined comments

based on “support,” “oppose,” or “neutral” for the project. Using these definitions, I used deductive coding to review the 1,715 public comments.

Going through each comment, I coded them based on implicit or explicit statements of support or opposition for the project, and if I could not define a sentiment, I coded it as neutral. Following this initial coding, I reviewed each code of sentiment a second and third time for accuracy. Using this coding, I then created two figures to look at the type of knowledge each code provided as well as the frequency of substantive commenting each received from the DNR. Using these figures, I compared knowledge type to substantive coding, which helped answer the question of whether the DNR valued comments from the support or opposition differently and if there could be any potential bias towards comments based on sentiment.

4.5 Analyzing Themes

Finally, I analyzed the public comments based on the DNR’s coding of them into different themes. This analysis of themes based on knowledge type and substantive coding involved none of my coding, but instead the DNR’s coding of substantive comments and their coding of themes. I contacted the DNR about their coding processes for issues and themes, and according to staff at the Division of Lands and Minerals, the agency’s technical staff reviewed comment submissions in a spreadsheet and defined themes and issues that arose from the documents (Irina Woldeab, personal communication, August 13, 2019). Coding comments in this way, the DNR found twenty-eight themes.

Using these themes, I created two graphs based on the expert and layperson knowledge the themes presented as well as their percent substantive comments from the

DNR. I then compare these two graphs to each other to see what themes based on the knowledge they provide received the most substantive coding from the DNR. Specific themes may inherently demonstrate the need for more technical expertise, but that does not necessarily mean there is only expert knowledge within that theme. I found it important to include this analysis to see if the DNR treated comments differently based on substantive coding from the type of knowledge provided when discussing each theme

4.6 Testing for Statistical Significance

For these analyses of knowledge types, substantive comments, groups, sentiment, and themes, this thesis used crosstabs to show the frequencies of each variable in the different analyses. The purpose of a crosstab—also known as a contingency table—is to display and compare, in my case, two variables to examine any relationships between the variables (Linneman, 2011). When using the crosstabs to examine relationships, because the data I collected and used in these tables was nominal, I used chi-squared tests to test if my sample population of data were likely to reflect an actual association between the variables I tested at a ninety-five percent confidence level (Linneman, 2011).

5 Results

5.1 Knowledge Type and Substantive Comments

First, to answer the question of how the DNR coded certain types of knowledge as substantive, I broke down the overall distribution of both the percent of substantive comments and the percent of expert and layperson knowledge. First, looking at the overall distribution of my sample of public comments by the percent of substantive coding in figure 5.1.1, the distribution of substantive and nonsubstantive coding from the DNR is quite close. Figure 5.1.1 shows that nearly forty-seven percent of the public comments the DNR coded as substantive. Additionally, figure 5.1.2 shows the distribution of my coding of expert and layperson knowledge. Looking at the distribution of these two knowledge types, roughly sixty-two percent of the 1,715 public comments I coded as layperson knowledge and, therefore, roughly under thirty-eight percent of those comments as expert knowledge. Looking at these two graphs helps to examine the distribution of comments by substantive and knowledge type coding but combining these data in one graphs shows how many expert and layperson comments the DNR coded as substantive.

Regarding the layperson knowledge represented in table 5.1.2, many of these comments presented less valuable information stating only support or opposition for the PolyMet project. For instance, Commenter A (2015) notes “It is not worth it. No to copper mining.” Commenter B (2015) states, “I SUPPORT the proposed PolyMet NorthMet copper-nickel sulfide mine!” These comments mostly seem like a vote in favor or against the project. While there may be some political importance of showing support

or opposition for this project and may subconsciously influence the DNR's coding processes, they do not provide much substance.

However, there are many layperson comments that do provide valuable information or suggestions that the DNR can consider when making their decision. For example, commenter C (2015) states that "…if PolyMet is allowed to go forward with this mining project, then I think that PolyMet should be required to pay a $300 million per year oversight and watchdog tax." Additionally, commenter D (2015) states "I have researched the EIS, and I believe the mine and the process are entirely safe. I was an engineer at the site from 1940 to 1984 and know that the tailings basin is well constructed." These comments should hold more value to the DNR than the comments of explicit support or opposition and bring up important suggestions or anecdotal information that the DNR could find as substantive.

Figure 5.1.1. Percent of Substantive Comments

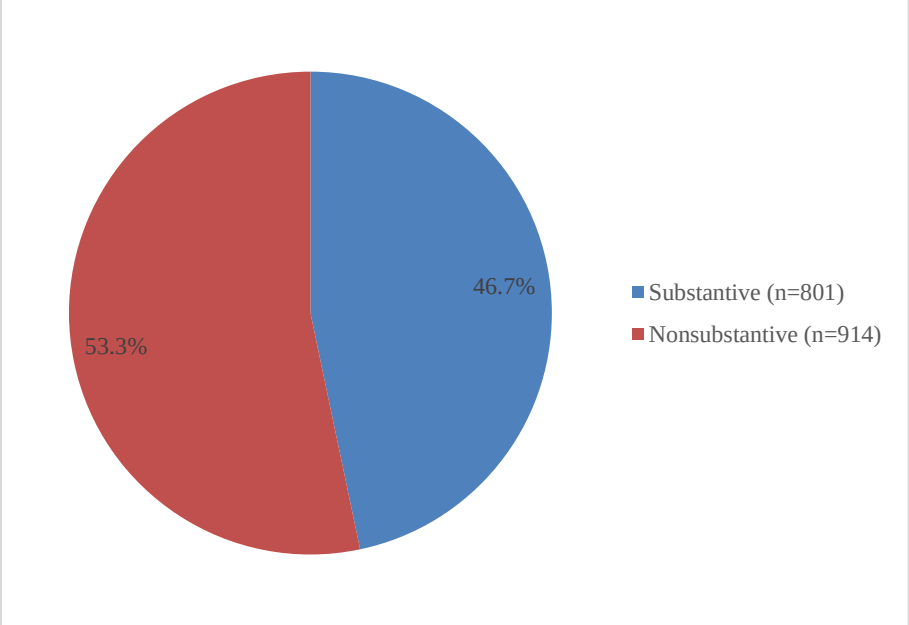


Figure 5.1.2. Percent Knowledge Type

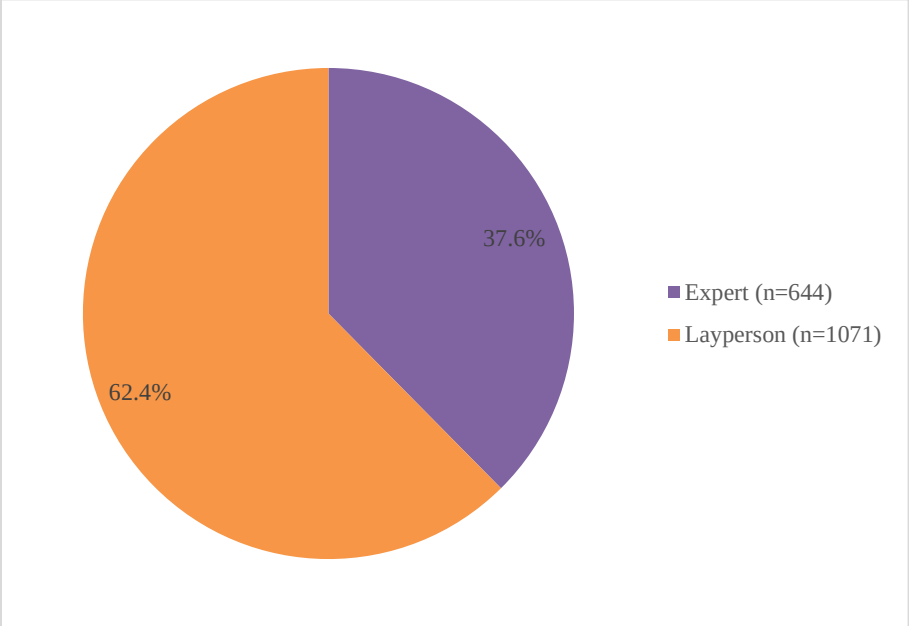
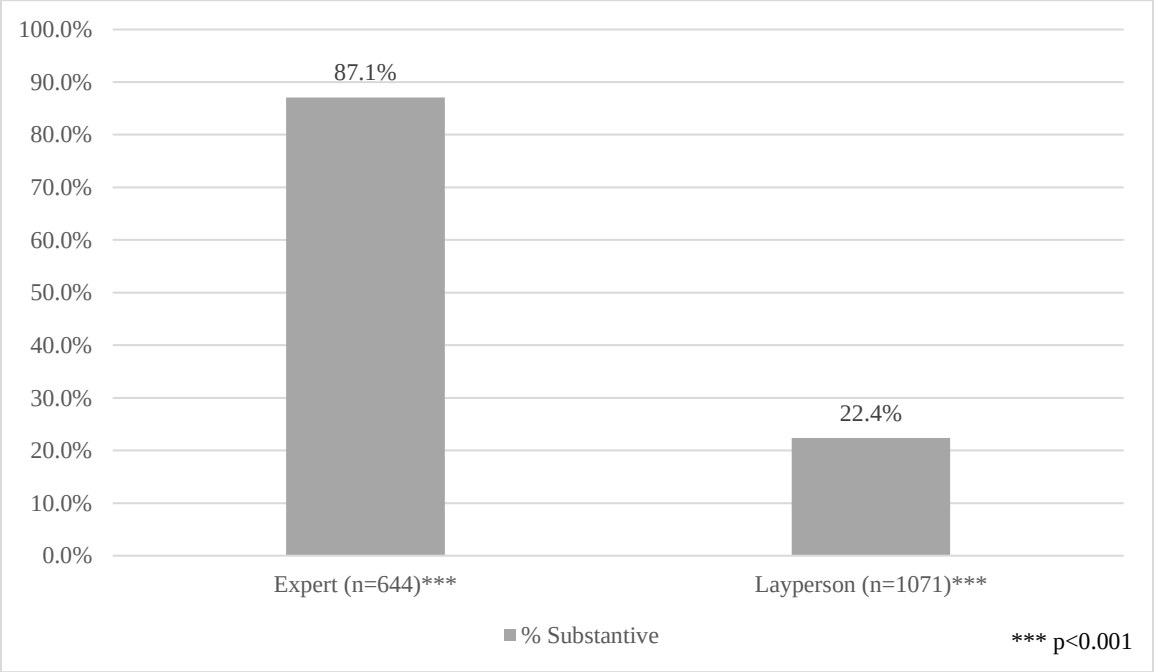


Figure 5.1.3 shows the percent of substantive DNR coding for expert and layperson knowledge types. We see here that of the 644 expert public comments, eighty-seven percent of those the DNR coded as substantive (figure 5.1.3). Alternatively, of the 1,071 layperson public comments, the DNR coded these comments as just twenty-two percent substantive (figure 5.1.3). This graph shows an unequal distribution of the DNR's substantive coding between the two knowledge types, where the DNR was much more likely to code public comments of expertise as substantive than the layperson knowledge.

Figure 5.1.3. Substantive Comments by Knowledge Type

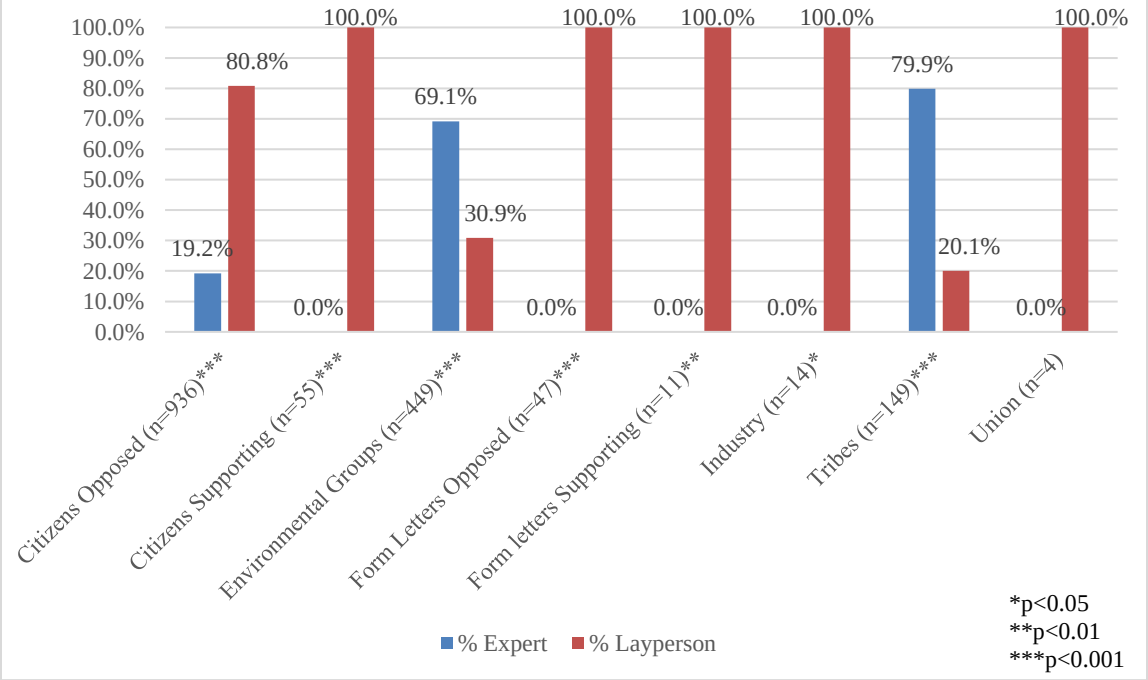


5.2 Group by Substantive Comments and Knowledge Type

To examine how the DNR coded public comments as substantive based on represented group, I defined eight groups from the submissions. These groups included citizens opposed, citizens supporting, environmental groups, form letters opposed, form letters supporting, industry groups, tribal governments and intertribal agencies, and union groups. Figure 5.2.1 shows the breakdown of these eight groups based on the percent knowledge type I coded in Nvivo. Only the union group (n=4) did not show any statistical significance at the $p<0.05$ level and the five groups with the largest number of

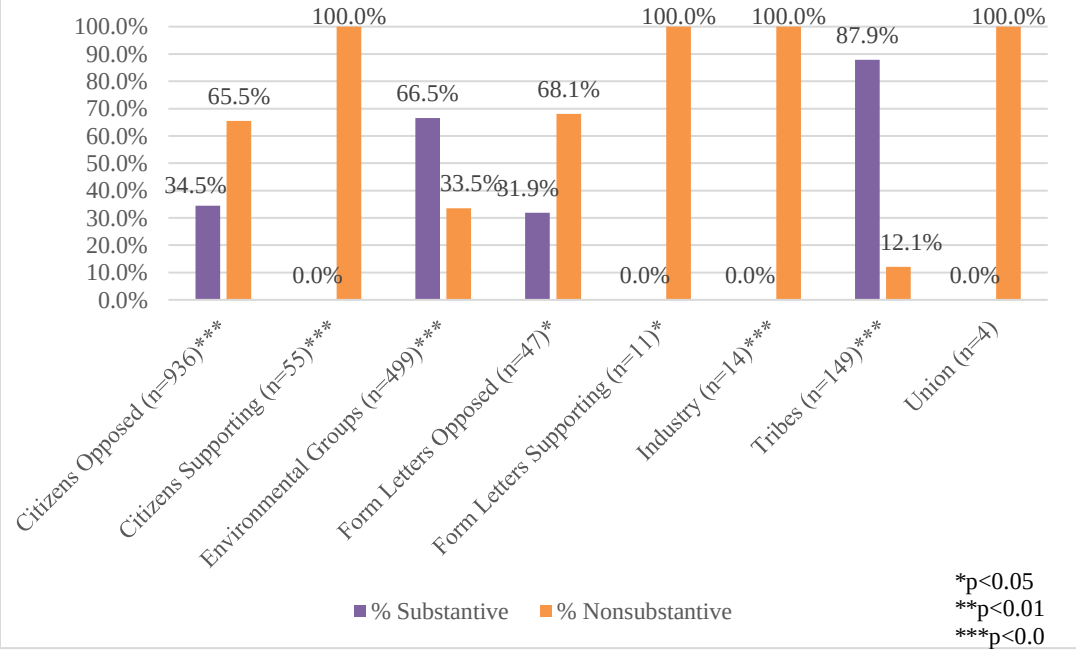
comments showed statistical significance to p<0.001 level (figure 5.2.1). Because the union groups in this statistical test were not statistically significant, I did not analyze them further than showing the distribution of expert and layperson knowledge. Of the seven groups that had a statistically significant relationship to knowledge type, only the citizens opposed, environmental groups, and tribes presented any expert knowledge while the remaining groups provided zero percent expert knowledge (figure 5.2.1). Of the three groups with expert knowledge, the environmental groups and tribes provided roughly sixty-nine percent and eighty percent expert knowledge, respectively, while citizens opposed provided under twenty percent (figure 5.2.1). Here, there is a clear differentiation between the type of group and the knowledge type they provide in public comments on the PolyMet project.

Figure 5.2.1 Group by Knowledge Type



Along with knowledge type, I analyzed the percent of DNR-coded substantive public comments based on the eight different groups in figure 5.2.2. As with my analysis of groups and knowledge type, the union group showed no statistical significance, while the remaining seven groups were significant to at least the $p<0.05$ level. Four of the seven statistically significant groups—citizens opposed, environmental groups, form letters opposed, and tribes—received any substantive coding from the DNR, while the remaining three showed zero percent (figure 5.2.2). The DNR coded the environmental groups and tribes with over fifty percent substantive coding with roughly sixty-seven percent and eighty-eight percent respectively. Alternatively, the citizens opposed and form letters received under fifty percent substantive coding with roughly thirty-five percent and thirty-two percent, respectively.

Figure 5.2.2. Group by Substantive Comments



I took these figures one step further and compared the expert knowledge with substantive coding of these groups. Here, the environmental groups and tribes had very

similar frequencies of expert knowledge and substantive comments. Again, the environmental groups had roughly sixty-nine percent expert knowledge and sixty-seven percent substantive coding from the DNR; the tribes had roughly eighty percent expert knowledge and eighty-eight percent substantive coding. Where there were differences, however, were with the citizens opposed and the form letters opposed. Both groups had less expert knowledge and more substantive DNR coding. Of the 936 citizens opposed comments, there is roughly a fifteen percent difference between expert knowledge and substantive coding; of the form letters opposed, there is a thirty-two percent difference in expert knowledge and substantive coding.

5.3 Substantive Knowledge Type by Sentiment

To answer the question of how the DNR values public comments as knowledge based on sentiment, I compared knowledge type and substantive commenting against those who support the project and those who oppose it. In my NVivo coding of sentiment, I also included a code for "neutral." However, zero of the 1,715 public comments stated or inferred neutrality; all either supported or opposed the project. First, I analyzed sentiment by how much expert or layperson knowledge supporters and opponents of the project provided. Figure 5.3.1 shows that comments of support provided zero percent expert knowledge ($p<0.001$), and opposing comments provided roughly thirty-nine percent expert knowledge ($p<0.001$). Second, in figure 5.3.2, I looked at the percent substantive public comments supporters and opponents received from the DNR. In this figure, comments of support received zero percent substantive coding ($p<0.001$) and opponents received thirty-nine percent substantive coding ($p<0.001$).

When thinking about these tables together, comments of support provided both zero percent expert knowledge and received zero percent substantive coding from the DNR. Alternatively, the comments of opposition provided roughly thirty-nine percent expert knowledge and received forty-nine percent substantive coding. Given the ten percent difference between knowledge type and substantive coding for public comments of opposition, this suggests that at least ten percent of the layperson comment of opposition received substantive coding.

Figure 5.3.1. Sentiment by Knowledge Type

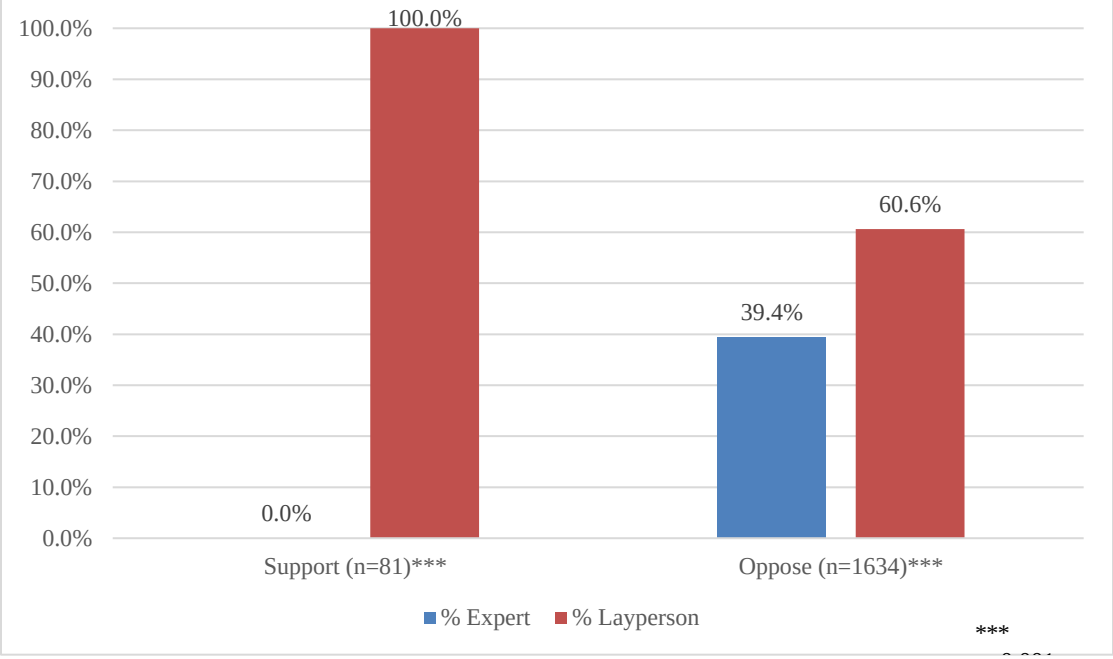
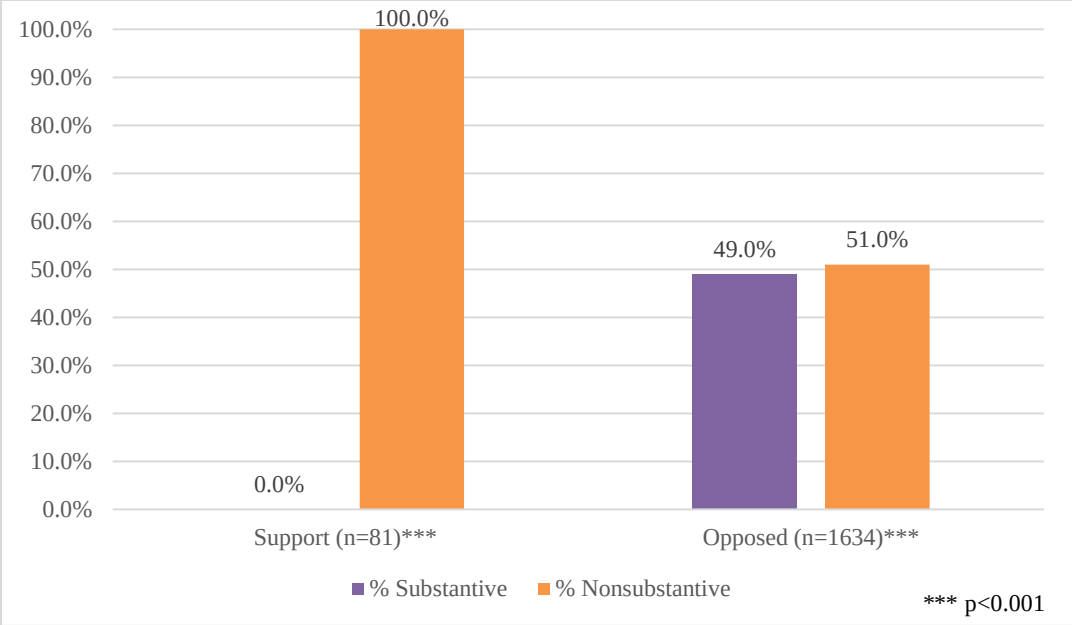


Figure 5.3.2. Sentiment by Substantive Comments



5.4 Substantive Expert and Layperson Knowledge by Themes

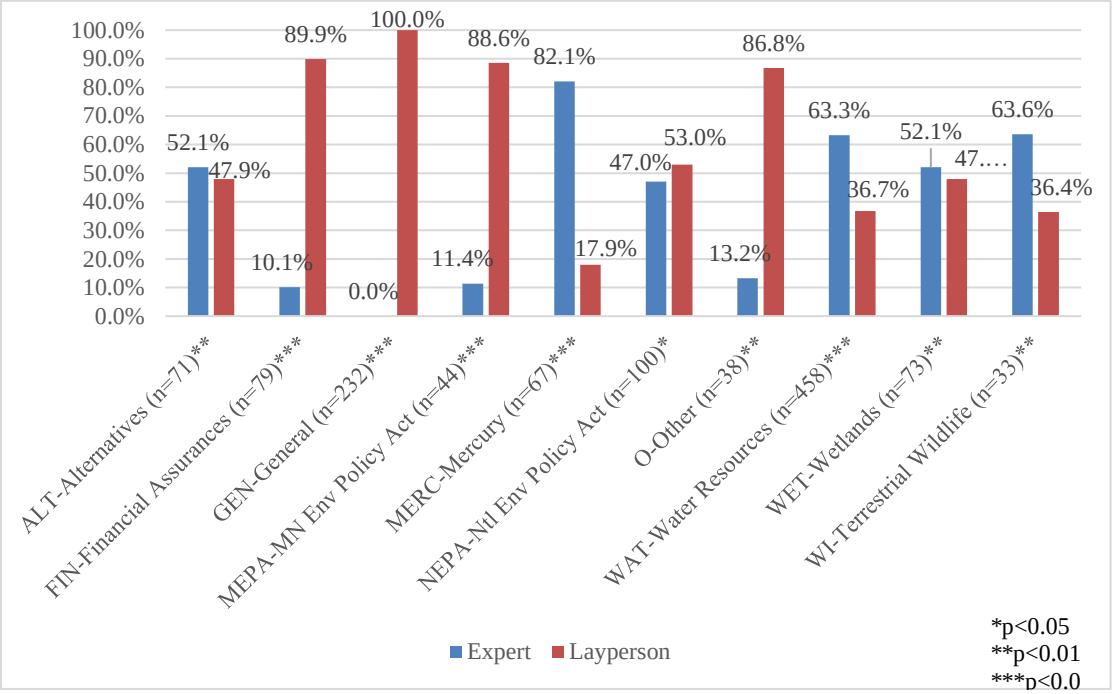
Finally, in examining the DNR's themes with knowledge type and percent of substantive coding, I used the ten of twenty-eight themes that showed statistical significance (p=0.05) in both my analysis of themes by knowledge type and themes by substantive comments. For a complete list and number of comments at each of the twenty-eight themes, see Appendix B. The ten themes that I analyzed were Alternatives (ALT), Financial Assurances (FIN), General (GEN), Minnesota Environmental Policy Act (MEPA), Mercury (MERC), National Environmental Policy Act (NEPA), Other (O), Water Resources (WAT), Wetlands (WET), and Terrestrial Wildlife (WI).

First, examining these ten themes by knowledge type, there are five themes that provide over fifty-percent expert knowledge—ALT, MERC, WAT, WET, and WI. Only one theme, General (GEN, n=232) provided zero percent expert knowledge (Figure 5.4.1). Of these themes that provided over fifty-percent expert knowledge, the more

scientifically technical themes of MERC, WAT, and WI provided the highest percentage of expert knowledge (figure 5.4.1). Interestingly, the GEN theme had the second-highest number of comments within it—second to WAT (n=458)—but still provided no expert knowledge given its large frequency (figure 5.4.1). I also point out that, except for the Minnesota Environmental Policy Act (MEPA) and National Environmental Policy Act (NEPA) themes, the themes that typically provide less technical expertise that made up my definition of expert knowledge.

Regarding those MEPA and NEPA themes, one often needs more expertise to make policy- or legal-based public comments and, therefore, could have provided more expert knowledge. However, when reviewing the text of the public comments from the MEPA and NEPA themes, the DNR coded many identical general statements and talking points from form letters that I coded as layperson knowledge. Because many of these talking points were similar within these two themes, it skewed the data to represent the MEPA and NEPA themes as providing a majority of layperson knowledge.

Figure 5.4.1. Themes by Knowledge Type

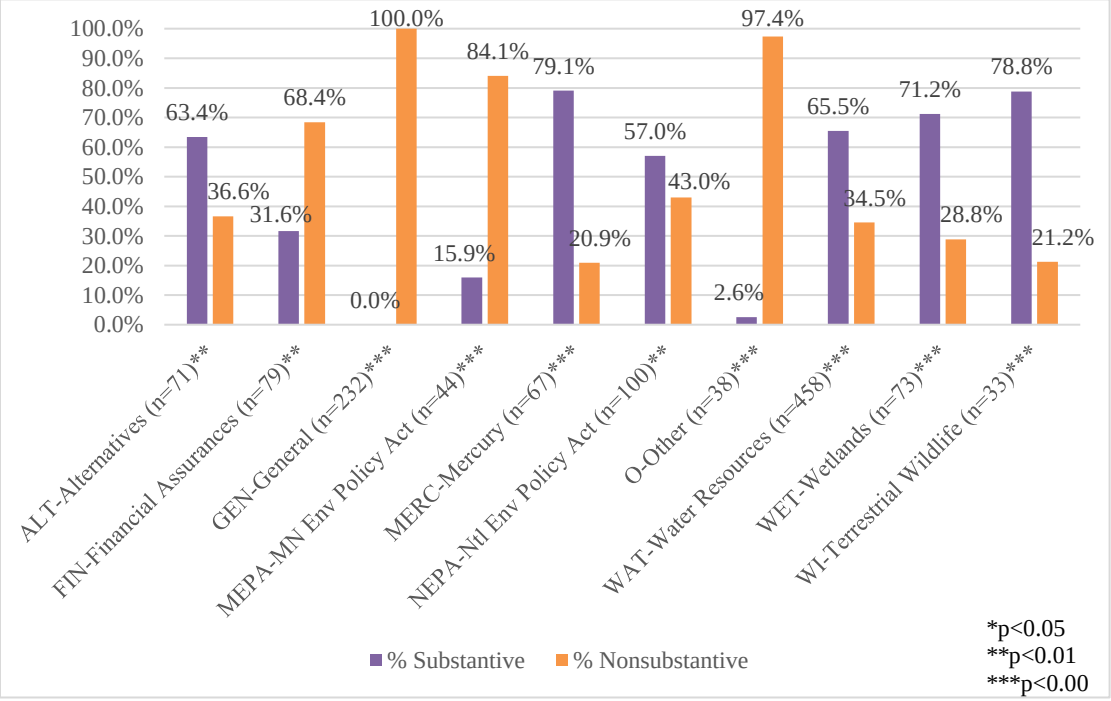


I also took these same ten themes and examined the percent of substantive commenting they received from the DNR in figure 5.4.2. Here, six themes received over fifty percent substantive coding—Alternatives (ALT), Mercury (MERC), National Environmental Policy Act (NEPA), Water Resources (WAT), Wetlands (WET), and Terrestrial Wildlife (WI). Alternatively, the General (GEN) and Other (O) themes received zero percent and under three percent substantive coding, respectively (figure 5.4.2). When comparing this substantive coding of themes to the knowledge types in figure 5.4.1, substantive commenting and expert knowledge run relatively consistent with each other. The themes that provide more expert knowledge all received over fifty percent substantive coding.

For every theme except for GEN and O, there was a higher percent of substantive coding than there was percent expert knowledge at each theme. This suggests that

layperson knowledge at each theme received at least some expert knowledge, albeit small. The most noticeable difference in percent substantive comments and knowledge type is the NEPA theme, which is the only topic that provided under half of its comments as expert knowledge but received fifty-seven percent substantive coding. This difference may suggest that the DNR took more seriously some of the more general policy-related statements that I coded as layperson in the NEPA theme and coded them as substantive.

Figure 5.4.2. Themes by Substantive Comments



6 Discussion

It is first necessary to note that, regardless of how the DNR coded and valued public comments on the PolyMet FEIS, under the Minnesota statutes and administrative rules on public commenting on environmental projects, the DNR met the legal requirements for this phase of environmental review. Under Minn. R. § 4100.2800, the DNR needed to collect comments on the adequacy of the FEIS over ten days before releasing a Record of Decision. In this case, state laws do not require the decision-making agency to respond to substantive comments but instead collect and consider them. In the case of the PolyMet mine proposal, the DNR went beyond the legal requirements by responding to substantive comments on the FEIS. Acknowledging that the DNR met the legal requirements for public comments, I can better discuss how the agency interpreted those laws and if there was any agency bias in how they value different types of knowledge as evidence.

In going beyond the legal requirements for public commenting, the DNR promoted the ideals of MEPA and NEPA to increase transparency and ensure public participation in environmental decision making. Like what Juntti et al. (2009), Radaelli (1995), and Yearley (2006) discuss citizen knowledge and its importance, the DNR, by incorporating these public comments, helped validate their decision-making process on the PolyMet project. This increased transparency and knowledge utilization may have ultimately helped the DNR enhance their policy decisions, knowing that citizen knowledge helps implement smart policy decisions about how decisions might affect the public, which is like Head's (2010a, 2015) discussion on policy legitimization. However, without more

direct communication with the DNR, it is difficult to determine if responding to substantive comments was indeed a way to incorporate citizen knowledge to make smart decisions or just a way to feign transparency to validate their decision. While they met the requirements, those requirements are open to interpretation by the decision-making agency.

6.1 Answering the Four Key Questions

First, was the DNR more likely to code knowledge types differently? Yes, expert sources of knowledge received the most substantive coding from the DNR (figure 5.1.2). Expert types of knowledge received nearly eighty-seven percent substantive coding while layperson knowledge received around twenty-two percent substantive coding.

Second, was the DNR more likely to code certain groups differently, given their knowledge type? Yes, and overwhelmingly so. While citizens opposing the project provided some expert knowledge (figure 5.2.1) and received some substantive coding (figure 5.2.2), the environmental groups and tribes, who have developed a larger capacity for providing expert types of knowledge, received a majority of all substantive coding of the 1,715 sample of public comments. This analysis suggests that the more resources a group has to conduct or contract technical research, the more likely that group's comments are to be coded as substantive. This leaves individual citizens and small citizen groups and others who provide more layperson knowledge with a smaller chance of having the DNR count their comment as substantive.

Thirds, did the DNR code comments based on sentiment of support or opposition differently? Groups opposed to the mine are concerned that their comments of opposition receive less substantive coding regardless of the type of knowledge they

provide. However, this is not the case. Figure 5.3.2 shows that comments from those opposed to the mine were more likely to be coded substantive than comments from those who supported the mine. In fact, no comments from supporters were coded as substantive. These outcomes could be caused by the types of knowledge the opposition and support provided (figure 5.3.1).

Finally, was the DNR more likely to code certain themes differently given their knowledge type? Yes, the more technical comments that provided more expert knowledge, such as Water Resources, Wetlands, and Terrestrial Wildlife Species (figure 5.4.2), received the most substantive coding (figure 5.4.3). The more technical or scientific the theme, the more likely it provided expert knowledge and received substantive coding. The General and Other themes provided little or no expert knowledge and received no substantive coding. These outcomes suggest that by focusing on certain themes and issues about the project, the more likely one is to have their comment counted as substantive.

6.2 Expert Knowledge Reigns Supreme

Despite the scholarly calls for evidence-based policymaking to become more inclusive of other sources of knowledge (Botterill and Hindmoor,2012; Head, 2010a), scientific expertise remains the dominant form of evidence used by decision-makers. Figure 5.1.3 first suggests the DNR's preference for expert knowledge when making their decisions on the PolyMet FEIS. Where the DNR coded roughly eighty-seven percent of the 644 expert public comments as substantive, they coded just twenty-two percent of the 1,071 layperson public comments as substantive. This suggests that the DNR favors technical knowledge. Similar outcomes were apparent in the groups and themes analyses.

As figures 5.2.1 and 5.2.2 show, the organizations that tended to have the greatest capacity to produce expert knowledge also received the highest percentage of substantive coding from the DNR. The environmental groups and tribes produced the highest percentage of expert knowledge. This is not entirely surprising, given that nonprofit organizations and tribal governments and intertribal agencies have developed resources and capacity to address scientifical and legal questions and analyze the information that the DNR provides.

Additionally, the analysis of the themes shown in figures 5.4.2 and 5.4.2 demonstrates a similar pattern: comments from groups with more expert knowledge result in more substantive coding from the DNR. The themes that tend to require more scientific knowledge provided the most expert knowledge (figure 5.4.1) and received the most substantive coding (figure 5.4.2). Although every theme received some substantive coding, which demonstrates some value from the DNR in layperson comments, themes that typically require and demonstrate more expertise hold more value to the agency.

That the expert groups and themes received more substantive coding helps demonstrate the persistence of evidence-based policymaking's focus on western sciences. This type of policymaking began as a way to bring these sciences into the decision-making process. Federal and state policies in the United States have continued to focus on technical scientific and legal expertise, despite the calls from scholars and the public for decision-makers to include additional voices (Hall and Jennings, 2010, Head, 2008; Maddison, 2012). Before we can expect state agencies to integrate broader forms of knowledge in their responses to public input, administrative guidelines will need to be rewritten to include criteria for coding those alternative forms of knowledge.

Figures 5.1.3 to 5.4.2 show that the agency may have held some value in layperson knowledge, but overall, layperson knowledge makes up a tiny percent of substantive DNR coding. However, the inclusion of any layperson knowledge at all may show an attempt from the DNR to include other sources of knowledge. But without clear administrative guidelines, agency personnel ultimately follow their values, beliefs, and outside influences to review public comments. Although the substantive coding guidelines might not explicitly state the exclusion of layperson knowledge, its lack of mention and focus on expert knowledge impacts how practitioners code and value different public comments.

The use of technical scientific evidence is necessary but not sufficient for agencies seeking greater public input. As Botterill and Hindmoor (2012) and others have noted, but a reliance on technical expertise to the exclusion of other kinds of knowledge has several flaws. Indigenous, citizen, and other sources of knowledge that may focus on lived experiences, beliefs, and values could potentially strengthen overall decision-making processes and streamline decision-making (Cairney et al., 2016; Grundmann, 2017; Head 2015). By leaving out other types of knowledge, the DNR may have more difficulty justifying their decisions (Mullen, 2018) for those who live in Minnesota and would be impacted by the PolyMet mine. Without this information, the DNR is challenged to know if this project will work here in the future for the citizens of the region. Evidence should include other forms of knowledge to inform better policies for all people (Lidskog & Sundqvist, 2002; Sanderson, 2009).

6.3 Bounded Rationality, Bias, and Other Challenges

Looking at figures 5.3.1 and 5.3.2 comparing sentiment by knowledge type and substantive coding, I wanted to know if the DNR held any potential bias, whether it be explicit or encased in bounded rationality, based on a commenter's sentiment for or against the project. Again, bounded rationality, according to Botterill and Hindmoor (2012) and Cairney (2019), is the notion that decision-makers cannot examine complex issues without incorporating values, beliefs, and political pressures into their analyses and decisions. Numerous public comments from opponents of the project claim that the DNR is biased against comments that are critical against the project. However, any bias that the DNR had based on sentiment was not necessarily against those opposed to the project. Based on tables 5.3.1 and 5.3.1, the DNR may have even been biased against public comments from supporters of the project.

The comments of opposition provided nearly thirty-nine percent expert knowledge—most of which probably came from environmental groups and the tribes, however—and an even higher percentage of substantive coding at forty-nine percent. Given this outcome, at least ten percent of those layperson comments of opposition the DNR counted as substantive, and they, overall, put a much higher value on their comments given that the substantive coding was nearly half of their comments. Looking at the comments of support shows something entirely different. These comments received both zero percent substantive coding and provided zero percent expert knowledge. The lack of expert knowledge from supporting comments may be a reason that the DNR coded zero percent as substantive.

Again, this project is highly controversial and has been a focus of many, which has resulted in over 30,000 comment submissions on this phase of the project alone. As Turnpenny et al. (2008) and Head (2010a) point out, highly controversial and politicized issues can overwhelm the decision-making process, and this can impact how decision-makers rationally make decisions to try to appease the most people as possible. The overwhelming process of the public comment period with so many varying opinions on the project may have impacted how the DNR ultimately reviewed comments of support and opposition. Many who oppose the project state that the DNR is biased in favor of the project, and these statements may have impacted the agency's rationality to review comments of opposition and support in order to seem fairer to those who oppose the project. This pressure may have led to a higher percentage of opposition comments being coded as substantive and less for those who support the project. This potential outcome does not necessarily demonstrate any explicit bias based on sentiment but could be explained by examining the impact of the project's controversy on the agency's rationality.

6.4 Political Agendas

One other way to think about how the DNR interpreted comments as evidence is whether they use these processes to legitimize their decisions through a symbolic gesture. As Juntti et al. (2009) and Majone (1989) note, decision-makers may often use evidence both symbolically and strategically to legitimize their already-decided-upon decision. Primarily with those who oppose the PolyMet project, they note that the DNR collects comments to simulate transparency and public input, while in reality, they are manipulating the process. Especially with the FEIS public comments analyzed in this

thesis being at the tail end of nearly fifteen years of environmental review, the DNR may have already had a decision in mind and held these comment periods because they had to and for political justification with the public. Although the DNR staff has shown that they do value certain public comments, given that the agency did not code layperson knowledge as substantive nearly as often as expert knowledge, citizens may be concerned about how much the DNR actually values public input.

7 Conclusion

7.1 Limitations of Research

The lack of semi-structured interviews for this thesis was the primary limitation of this thesis. I attempted to interview key actors such as environmental organizations, labor groups, tribal governments and intertribal agencies, citizen groups, and the DNR. However, despite multiple emails and phone calls, of the fifteen people I contacted, only two agreed to an interview. Six responded to my inquiries; two of those refused an interview; one initially agreed but then ignored all future contact; and one agreed to an interview but only at a later date. Two people did agree to have either a formal or informal interview. One group wanted an informal preliminary phone call, and I was unable to use notes from this call in this thesis. One person from an environmental group did agree to a semi-structured interview, which I conducted in August 2018.

These interviews may have provided a greater insight into the public commenting process beyond interpreting the comments themselves. However, they do not detract from the overall findings and contributions to evidence-based policymaking scholarship from this thesis. The inclusion of interviews in the future may provide one of many opportunities for empirical research on this subject.

7.2 Opportunities for Future Research

In addition to interviews to provide more insight into the public commenting process and to better understand the DNR's coding processes, there are other opportunities for future research about how the DNR interprets public comments as evidence in Minnesota. For instance, there are five separate public comment periods on the PolyMet

project with different legal requirements for how to collect and analyze public comments. This thesis looked at just one of those five public comment periods, and there is an opportunity to do analyses of each comment period separately or together to understand how the DNR interprets the laws and public comments when using evidence.

The final comment period for the PolyMet mine project involved the DNR's and MPCA's permits for the company. An analysis of the comment period would be fascinating to examine because it allows a researcher to compare how two state agencies interpret their respective laws on public comments. Further, there is also much controversy surrounding one of the MPCA's permits because it hid critical comments from the EPA in their final decision (Kraker, 2019a). Given this revelation, it may be interesting to review how the MPCA treated all comments on their permit when making their final decisions. If the agency was willing to suppress comments from the EPA, were they ultimately biased when analyzing the public's comments?

Another analysis that this thesis could not take on was examining the DNR's policy analytical capacity and ability to collect and process public comments. How do education, expertise, technology, political motivation and pressure, and organizational structure and culture (Voyer, 2007; Howlett, 2009) impact how the DNR codes public comments? In thinking about organizational culture and structure, the Division of Lands and Minerals under the DNR works in multiple policy domains, including economic and land development and environmental regulation. Head (2016) and Howlett (2015) note that different policy domains often contain different analytical capacities because of the type of research they rely on to make decisions. What are the differences in these organizational capacities to conduct research? The Lands and Minerals division is just

one of seven divisions under the DNR. Of the seven divisions, Lands and Minerals receives the least amount of funding. In the DNR's most recent biennial budget of 1.1 billion dollars, the Division of Lands and Minerals received just two percent of that funding (DNR, 2018a). How do these potential budgetary constraints impact the type of work and workforce the DNR can put forward for public comments?

Finally, using the tables here and adding additional discourse and textual analyses may help us to understand if the DNR used certain comments to support an already-determined agenda. For instance, I found that commenters on different sides of the mining issue argued that the DNR has a political agenda in the permitting process. One way to examine if the DNR has a political agenda for or against the PolyMet project is to analyze how they interpreted comments based on their response to and incorporation of substantive comments and their justification for coding comments as nonsubstantive. As Black (2001) discusses, if evidence supports a policy goal, a decision-maker may use that data to help justify their decisions, but if evidence does not wholly support or opposes the policy goal, agencies use it sparingly. Selective use of evidence for a policy goal applies well to how the DNR interpreted policies to review public comments.

7.3 Rethinking Expertise in EBPM

This thesis shows that to use public comments in the decision-making process on the PolyMet proposal, the DNR needed to navigate through policy requirements and to collect and use those comments as evidence. The legal requirements under MEPA, NEPA and other state administrative rules (see 40 C.F.R. §1502.1; Minn. R. § 4410.0200-.6500; Minn. Stat. § 116D) are open to interpretation when discussing public commenting. I found that, under these rules and regulations for public commenting, the DNR followed

the law when collecting and reviewing public comments. In the case of the FEIS in this analysis, the DNR went beyond the legal requirements by extending the comment period and responding to all substantive comments. However, while the DNR did follow these laws in collecting comments, interpreting those laws was much more complicated.

With the DNR's interpretation of comments, they tended to treat different types of knowledge differently. Expert knowledge remains the top priority in evidence-based policymaking based on how the DNR treated different knowledge types, groups, and themes. Though this analysis highlights the agency's preference of expert knowledge as evidence, this thesis also highlights some of the challenges that the DNR may have encountered when reviewing public comments, as well as some issues with evidence-based policymaking. These data highlight that using evidence in complex and politically divisive issues is difficult and that the DNR, while attempting to remain apolitical, may have been influenced by bounded rationality, favoring one type of evidence over the other. Scholars note the importance of going beyond treating scientific evidence as the gold standard and incorporating other forms of knowledge in evidence-based policymaking. As Head (2010b) notes

> The politics of decision making inherently involves a mixing of sciences, value preferences, and practical judgments about feasibility and legitimacy. Outside the scientific community, the realm of knowledge and evidence is even more diverse and contested…The professional crafts of policy and program development require "weaving" these strands of information and values (13).

The idea that science and analysis are objective and other forms of knowledge are lesser inhibits the ability of agencies to make the soundest decisions that are transparent

and justifiable for most people. While the DNR has demonstrated care for public comments, the more that they and other agencies reform rules and thought processes for treating substantive comments, the more transparent, democratic, and effective those processes will be to include citizen, professional, political, indigenous, and other sources of knowledge.

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A DNR Thematic Coding Definitions

AIR: Air Quality

ALT: Alternatives

AQ: Aquatic Species

COE: USACOE 404 Permit

CR: Cultural Resources

CUM: Cumulative Effects

EDIT: Editorial

FIN: Financial Assurances

O: Other

GEN: General Opinion

GT: Geotechnical Stability

HAZ: Hazardous Materials

HU: Human Health

LAN: USFS Land Exchange

LU: Land Use

MERC: Mercury

MEPA: Minnesota Environmental Policy Act Adequacy

N: Noise and Vibration

NEPA: National Environmental Policy Act Adequacy

PD: Project Description

PER: Permitting and Regulatory Considerations

ROD: Record of Decision

SO: Socioeconomic Impacts

VEG: Vegetation

WAT: Water Resources

WET: Wetlands

WI: Terrestrial Wildlife Species

WILD: Wilderness and Special Designation Areas

B List of Federal and State Laws and Regulations

Table 2.1. State and federal laws and regulations specific to the PolyMet project

	Law	Definition
State	Minn. R. § 4410	Environmental Review: Sets the regulations for environmental review and environmental impact statements under Minnesota State law (MEPA).
	Minn. R. § 4410.0200	Definitions and Abbreviations: Sets the definitions discussed throughout the MEPA regulations, including "environmental impact statement," "EQB," and "environmental assessment worksheet."
	Minn. R. § 4410.0300	Authority, Scope, Purpose, and Objectives: Defines the purpose of the Minnesota Environmental Policy Act to ensure environmental protection from human activity.
	Minn. R. § 4410.0500	Responsible Governing Unit (RGU) Selection Procedures: Defines which state agency is the RGU of a project and the RGU's discretion over projects.
	Minn. R. § 4410.2600	Draft EIS: Notes when an RGU will prepare a drat EIS; the distribution of the draft; and public commenting and RGU response to comments.
	Minn. R. § 4410.2700	Final EIS: Notes that the FEIS needs to respond to substantive comments on the draft EIS and scoping and discuss opposing views and how the RGU will distribute the FEIS to the public.
	Minn. R. § 4410.2800	Determination of Adequacy: Discusses who makes the Determination of Adequacy on a project; sets standards for public comments on the adequacy of a FEIS; the conditions of making an adequacy decision; and notes if the EIS is inadequate, the RGU has sixty days to prepare and adequate EIS.

	Minn. R. § 4410.3000	Supplementing EIS: Sets the criteria for the RGU to prepare a supplemental EIS document and notes that any person may request and supplemental EIS.
	Minn. R. § 4410.3900, subpart 1	Joint Federal and State Environmental Documents: Sets up when federal and state agencies should work cooperatively and the joint responsibilities of those agencies.
	Minn. R. § 6132.4000, subpart 2	Objection to Proposed Mining Operations: Notes how a person can provide a written objection to a Permit to Mine; sets rules for a substantive public comment and objection.
	Minn. Stat. § 116D.01	Purpose: The purpose of the MEPA, codified into law in 1973 to promote environmental protection and minimal damage from human interaction.
	Minn. Stat. § 116D.04	Environmental Impact Statements: Defines and EIS and the requirements for creating, reviewing, modifying, and finalizing and EIS.
Federal	40 CFR § 1502	Environmental Impact Statement under the National Environmental Policy Act (NEPA)
	40 CFR § 1503	Commenting on and EIS under NEPA: Notes the requirement of specificity of public and agency comments on an EIS and the Lead Agency's response to comments.
	40 CFR § 1506	Other requirements of NEPA: Sets the limitations of the NEPA process, the elimination of duplicate procedures with local and state laws and regulations, including the public in NEPA, the responsibility of the Lead Agency, and more.
	42 U.S. Code § 7609	Policy Review: Notes that the EPA administrator must review and comment in writing on the adequacy of a project's environmental impact on federal projects.

	40 CFR § 1502.9	Draft, Final, and Supplemental Statements: Notes the agency will create the EIS in two stages of a draft and final EIS and respond to substantive comments. Notes that the agencies can prepare a supplemental draft or final environmental impact statement if there are major changes to the original EIS or if there is new information relevant to the EIS not yet discussed.

Table 2.2. Suggestions of substantive comments by the EQB and DNR and examples of substantive comments

	Suggestion	**Example**
Environmental Quality Board (EQB) suggestions for substantive comments	Point out inaccuracies in the document	"Insufficient or inaccurate geochemical characterization of the proposed mine: The primary causes of geochemical characterization failures were identified as lack of adequate geochemical characterization, in terms of sample representativeness and sample adequacy."
	Discuss and prove other environmental issues not yet discussed	"The study does not appear to even address the energy demands of the project. I may be wrong, but I could find no analysis of the energy that will be required to get this low grade (sic) ore from the ground and concentrate it into a form in which it can be marketed. I believe that is a gross error that should be addressed—especially in these days of heightened awareness to the long-term consequences of global climate change and the need for each country to manage its energy use to reduce carbon emissions. I may be wrong, but I have heard that Minnesota Power is already soliciting the expansion of western coal mining in order to meet the

		demand of the proposed PolyMet operation. So what is this demand and how will it be met? And what is the overall carbon contribution to the atmosphere from it? This is a related action to the project that, again, could have unintended negative consequences to the region if not the world."
	Discuss and prove that environmental issues mentioned were not adequately addressed	"p.5-89 'distillation crystallization unit to eliminate the liquid reject stream. The moist waste solids from this system would be disposed of off site.' -Googling distillation crystallization does not identify any existing technology by that name. Again, solids should not be disposed of offsite where PolyMet would escape responsibility for their monitoring and release. The pilot testing has no more foundation for reliability than the modeling."
	Discuss other mitigation methods that the decision-making agency should include in the document	However, the map (co-lead agency memo Figure 8) of proposed monitoring well locations shows sparsely placed wells all within or very close to the PolyMet project boundary. To be effective, bedrock monitoring wells should be at greater distances from the PolyMet project boundary. In particular, monitoring wells should be placed farther north from the edge of the Type I stockpile. Surficial aquifer containment efforts at the Type 1 stockpile may interfere with interpretation of bedrock well readings at the immediate edge of the Type 1 stockpile.

DNR's suggestions for substantive comments	Comments on whether the DNR and FEIS analyzed topics identified in the scoping and environmental review phases of the project	"However, the argument that a separate dry stack tailings basin would increase the 'footprint' of the project does not mean it would increase environmental impacts. The Co-Lead Agencies may no longer remember this, but there are many brownfield sites in close proximity to the LTVSMC processing plant. In fact, several of these sites were identified as alternative tailings locations in the 2005 Final Scoping Decision for the NorthMet project, as reflected in the Exhibit 27 map attached. It was incumbent upon the Co-Lead Agencies, based on comments, the Independent Report and their own evaluation that dry stacking would improve tailings basin stability, to review these and other nearby brownfield sites, environmental risks and life-cycle costs and rigorously evaluate best available tailings disposal technology for the NorthMet project."
	Comments on whether the DNR adequately responded to public comments on the SDEIS	"Allowing only 90 days for public comment for this project is inadequate to fully vet objections to the project which PolyMet and lead agencies have allegedly spent tens of millions of dollars and more than 9 years. The comments given below should be given deference for judicial review under these circumstances or be determined to violate due process notice and comment requirements. The comments given should be regarded

		as conservative objections and be given a broad reading."
	Comments on whether the DNR followed the legal requirements for preparing an EIS under federal and state regulations	"The FEIS also fails in the legal directive to rely on independent, objective assessments of environmental harm. The use of water flow models created and run by consultants hired by PolyMet undercuts the purported objectivity of the evidence."